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414553

U. S. ARMY

TRANSPORTATION RESEARCH COMMAND

TRECOM TECHNICAL REPORT 63-10

Automatic Light Aircraft Readiness Monitor
Project ALARM

VOLUME II

Project 9R89-02-015-16 Contract DA 44-177-TC-641

January 1963

prepared by :

York Division of The Bendix Corporation York, Pennsylvania



63-4-5

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Task 1D141812D18416 (Formerly Task 9R89-02-015-16) Contract DA 44-177-TC-641 TRECOM Technical Report 63-10 January 1963

Project ALARM
AUTOMATIC LIGHT AIRCRAFT READINESS MONITOR
Phase II Test Program

VOLUME II

APPENDICES

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APPENDIX I

INSTALLATION DRAWINGS, ALARM

- 1. E1676475 Installation, Interlocks, Control Display Box, Power Supply Supply
- 2. E1676492 Installation, Engine Oil Level Sensors
- 3. C1676474 Installation, Fuel Filter
- 4. C1676468 Installation, XMSN Pressure Relief Valve
- 5. D1676466 Installation, 420 Gear Box Sensors
- 6. D1676465 Installation, 90 Gear Box Sensors
- 7. C1676487 Installation, Engine Sensors
- 8. D1676467 Installation, XMSN Accessory Gear Box Sensors
- 9. D1676469 Installation, XMSN Temperature & Vibration Sensors
- 10. C1677335 Installation, Tail Vibration Sensor
- 11. C1677334 Installation, Low Frequency Vibration Sensor
- 12. C1677339 Installation, Engine Oil Flowmeter
- 13. D1677336 Installation, XMSN Input Quill Temperature Sensor
- 14. C1676470 Installation, Swashplate Bearing Temperature Sensor
- 15. C1676464 Installation, Hanger Bearing Temperature Sensor

These drawings will be furnished by USATRECOM upon written request to those agencies on the distribution list.

APPENDIX II

OPERATIONAL TEST DATA *

- A. Transmission Top Vibration
- B. Transmission Base Vibration
- C. Aft Engine Vibration
- D. Forward Engine Vibration
- E. Tail Vibration
 - * All operational test data were recorded during the period of March 3, 1961, to June 16, 1961.

T.

| | ELICHT TEST DATA - ALARM T | TRANSMISSION TOP VIBRATION | ION TOP | VIBRATIC | N. | DATA R | DATA RECORDED IN G'S (PK) | IN G'8 |
|------------|----------------------------|----------------------------|---------|----------|--------|---------|------------------------------|--------|
| | ATTITUDE | 1-2KC | 2-4KC | 4-8KC | 8-12KC | 12-16KC | 16-20KC | ALL |
| Ground Run | Run 5800 RPM * | 4.6 | 8.5 | 8.8 | 9.6 | 5.3 | 2.8 | 14 |
| Ground Run | l Run 5800 RPM | 4.0 | 8.0 | 8.7 | 8.7 | 5.7 | 3.1 | 14.0 |
| Straight & | nt & Level 70K | 5.3 | 14.0 | 18.0 | 13.0 | 10.5 | 8.0 | 30.0 |
| Straig | Straight & Level 80K | 4.4 | 13.0 | 17.0 | 14.0 | 11.5 | 8.7 | 27.0 |
| Climb | Climb 500'/Minute | 5.3 | 13.0 | 14.0 | 14.0 | 12.0 | 4.8 | 28.0 |
| Climb | Climb 500'/Minute | 4.4 | 12.0 | 15.0 | 14.0 | 13.0 | 8.7 | 28.0 |
| Climb | Climb 2500'/Minute | | | | | | | 31.0 |
| Straight | tht & Level 70K | 4.4 | 13.0 | 15.7 | 16.6 | 8.8 | 7.0 | 26.0 |
| Hover | | 4.7 | 13.0 | 14.0 | 13.0 | 10.5 | 7.0 | 26.0 |
| Groun | Ground Run 6000 RPM | 4.6 | 9.2 | 14.0 | 11.2 | 8.3 | 4.1 | 22.5 |
| Straig | Straight & Level 70K | 9.2 | 12.5 | 16.5 | 13.0 | 9.6 | 7.0 | 26.0 |

* Mounted Vertically

SECTION A (Cont'd.)

| FLIGHT TES | FLIGHT TEST DATA - ALARM TRANSM | ISSION TC | TRANSMISSION TOP VIBRATION (Cont'd.) | FION (Con | t'd.) | DATA RI | DATA RECORDED IN G'S (PK) | IN G's |
|------------|---------------------------------|-----------|--------------------------------------|-----------|----------|---------|------------------------------|--------|
| DATE | ATTITUDE | 1-2KC | 2-4KC | 4-8KC | 8-12KC | 12-16KC | 16-20KC | ALL |
| 5/4 | Straight & Level 70K ** | 4.8 | 15.8 | 12.6 | 7.0 | 3.4 | 2.2 | 23.5 |
| 5/2 | Climb 5001/Minute | 5.5 | 17.0 | 18.0 | 9.7 | 5.4 | 3.3 | 28.0 |
| 5/5 | Hover | 5.3 | 18.3 | 15.0 | 9.6 | 6.1 | 2.6 | 25.5 |
| 2/6 | Hover | 5.7 | 20 | 16.6 | 11.3 | 6.1 | 8.7 | 30.0 |
| 3/6 | Auto-Rotation | | | | | | | 13.0 |
| . 5/6 | Maximum Takeoff | | | | | | | 34.5 |
| 9/9 | Right Turn | | | | | | | 29 |
| 9/9 | Left Turn | | | | | | | 29 |
| 9/6 | Straight & Level 105K | | | | | | | 30.5 |
| 6/9 | Ground Run 6000 RPM | 7.4 | 16.6 | 11.0 | eo. ∞ | 2.4 | 2.0 | 23.5 |
| 5/9 | Auto-Rotation | | | | | | | 22.0 |
| | | | | | | | | |

** Accelerometer Mounted @ 450

CP NBOR

SECTION A (Cont'd.)

| FLICHT TE | FLIGHT TEST DATA - ALARM TRAI | TRANSMISSION TOP VIBRATION (Contid.) | i Top vib | RATION (| Cont'd.) | DATA R | DATA RECORDED IN G'S (PK) | IN G's |
|-----------|-------------------------------|--------------------------------------|-----------|-------------|----------|------------|---------------------------|--------|
| DATE | ATTTTODE | 1-2KC | 2-4KC | 2 36 | 8-12KC | 12-16KO | - | ALL |
| 5/9 | Right Turn | | | | | | | 24.6 |
| 5/9 | Left Turn | | · | | | | | 24.5 |
| 5/9 | Straight & Lovel 100K | | | | | | | B.0 |
| 9/9 | Straight & Lovel 70K | 5.6 | 18.2 | 15.8 | 9.6 | 5.4 | 3.5 | 28.0 |
| 8/8 | Straight & Lovel 100K | | | | | | | 3.8 |
| 6/5 | Straight & Lovel 70K | 5.7 | 17.5 | 15.8 | 11.4 | 8.9 | | 8.0 |
| 9/9 | Ground Ben (6000) | 5.7 | 18.5 | 13 | 8.8 | 4.1 | M | 8 |
| 9/9 | Ground Run (6400) | 9.6 | 24 | 14 | 10 | 5.4 | 2.7 | \$2.0 |
| 9/9 | Straight & Lovel BOK | 6.1 | 17.4 | 17.4 | 10.0 | 6.6 | 3.7 | 28.0 |
| ** | Climb 500'/Mimbe | • | 17.5 | 16.5 | 13.0 | 6.5 | 4.0 | 31.0 |
| 9/8 | Climb 2500'/Minute | | | | - | | | 37.0 |

SECTION A (Cont'd.)

| | FLIGHT TES | FLIGHT TEST DATA - ALARM TRANSN | DESTON TO | TRANSMISSION TOP VIBRATION (Cont'd.) | TION (Con | t'd.) | DATA R | DATA RECORDED IN G'S (PK) | S. D NI |
|---|------------|---------------------------------|-----------|--------------------------------------|-----------|--------|---------|------------------------------|---------|
| | DATE | ATTITUDE | 1-2KC | 2-4KC | 4-8KC | 8-12KC | 12-16KC | 16-20KC | ALL |
| | 8/8 | Ночег | 5.7 | 17.5 | 14 | 10.5 | 5.7 | 3.5 | 27 |
| J | 8/7 | Hover | 5.3 | 15.8 | 13 | 9.6 | 5.3 | 3.2 | 26 |
| 1 | 9/9 | Hever W 1000.# Load | 7.9 | 18 | 11 | 12.2 | 6.6 | 4.0 | 29 |
| 6 | 6/7 | Hover W 1000 # Load | 6.1 | 17.5 | 17.5 | 12.2 | 6.6 | 3.7 | 30 |
| | 6/7 | Straight & Lovel - 70K | 5.3 | 17.5 | 16 | 11.8 | 6.1 | 3.5 | 30 |
| · | 6/7 | Straight & Level – 90K | 5.3 | 18.3 | 17 | 8.5 | 7.0 | 4.2 | 32.5 |
| i | 8/9 | Straight & Level ~ 70-80K | 5.3 | 16.7 | 15 | 9.6 | 5.3 | 3.7 | 27 |
| | 8/8 | Straight & Level - 100K | 6.1 | 18.3 | 17.5 | 11.3 | 6.5 | 3.5 | 31.5 |
| i | 8/8 | Ground Run 6400 RPM | 6.3 | 24.5 | 13.5 | 9.6 | 5.3 | 8.8 | 31.5 |
| | 6/9 | Ground Run 6400 RPM | 6.1 | 21.8 | 12.6 | 8.8 | 4.4 | 2.3 | 28 |
| | 6/7 | Right Turn | | | | | | | 28 |
| | | | | | | | | | |

SECTION A (Cont'd.)

| FLIGHT TE | FLIGHT TEST DATA - ALARM TRANSM | TRANSMISSION TOP VIBRATION (Cont'd.) | OP VIBRA | TION (Con | t'd.) | DATA R | DATA RECORDED IN G'S (PK) | s, D NI |
|-----------|---------------------------------|--------------------------------------|----------|-----------|--------|---------|---------------------------|---------|
| DATE | ATTITUDE | 1-2KC | 2-4KC | 4-8KC | 8-12KC | 12-16KC | 16-20KC | ALL |
| 2/9 | Left Turn | | | | | | | 28 |
| 2/9 | Maximum Takeoff | | | | | | | 36 |
| 6/7 | Auto-Rotation | | | | | | | 24.5 |
| 6/9 | Maximum Takeoff | | | | | | | 38.5 |
| 6/9 | Climb 2500'/Minute | | | | | | | 38.5 |
| 6/13 | Hover W 1000 # Load | 6.0 | 16.5 | 15 | 12.2 | 6.3 | 3.5 | 30.5 |
| 6/14 | Straight & Level - 70-80K | | | | | | | . 29 |
| 6/14 | Straight & Level - 90-100K | | | | | | | 32 |
| 6/14 | Climb 500'/Minute | | | | | | | 33 |
| 6/14 | Climb 2500'/Minute | | | | | | | 45 |
| 6/14 | Maneuver Right Turn | | | | | | | 29 |

SECTION A (Cont'd.)

| | FLIGHT TE | FLIGHT TEST DATA - ALARM TRANSM | BSION TO | TRANSMISSION TOP VIBRATION (Cont'd.) | TION (Con | t'd.) | DATA R | DATA RECORDED IN G'S (PK) | IN G's |
|----------------|-----------|---------------------------------|----------|--------------------------------------|-----------|--------|---------|------------------------------|--------|
| ············ | DATE | ATTITUDE | 1-2KC | 2-4KC | 4-8KC | 8-12KC | 12-16KC | 16-20KC | ALL |
| | 6/14 | Maneuver Left Turn | | | | | | | 28 |
| | 6/14 | Auto-Rotation | | | | | | | 24.5 |
| <u>-</u> | 6/14 | Maximum Takeoff | | | | | | | 41 |
| 8 | 6/14 | Straight & Level - 70-80K | | | | | | | 29 |
| | 6/14 | Straight & Level - 90-100K | | | • | | | | 32 |
| | 91/9 | Ground Run 6400 RPM | | | | | | | 30.5 |
| 1 | 6/16 | Hover | | | | | | | 28 |
| - - | 8/16 | Hover W 1000 # Load | | | | | | | 30.5 |
| | 91/9 | Hover @ 2000' MBL | | | | | | | 30 |
| | | | | | | | | | |
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| FLI | GHT TES | FLIGHT TEST DATA - ALARM | TRANSMISSION BASE VIBRATION | ion base | VIBRATI | NO | DATA R | DATA RECORDED IN G'S (PK) | s, D NI |
|------|---------|--------------------------|-----------------------------|----------|---------|--------|---------|------------------------------|---------|
| I | DATE | ATTITUDE | 1-2KC | 2-4KC | 4-8KC | 8-12KC | 12-16KC | 16-20KC | ALL |
| 3/3 | | Ground Run 5800 RPM | 2.7 | 7.5 | 9.7 | 6.0 | 2.9 | 1.6 | · |
| 3/8 | ø. | Ground Run 5800 RPM | 1.5 | 6.7 | 6.7 | 5.0 | 3.0 | 2.0 | 10.1 |
| 3/10 | 10 | Straight & Level - 70K | 1.0 | 4.0 | 8.3 | 7.2 | 4.1 | 2.7 | 10.5 |
| 3/11 | 11 | Straight & Level - 80K | 3.8 | 8.2 | 13.0 | 8.2 | 4.5 | 2.6 | 25.0 |
| 3/11 | 11 | Climb 500'/Minute | 3.8 | 8.2 | 12.0 | 7.5 | 5.0 | 2.6 | 18.0 |
| 3/11 | 11 | Climb 500'/Minute | 3.8 | 7.5 | 13.0 | 7.5 | 4.5 | 2.7 | 16.0 |
| 3/11 | 11 | Climb 2500'/Minute | | | | , | | 3 | 15.0 |
| 4/21 | - | Straight & Level - 70K | 3.4 | 8.2 | 12.8 | 7.5 | 4.9 | 3.0 | 15.8 |
| 4/21 | - | Hover | 3.3 | 7.5 | 13.5 | 7.5 | 4.5 | 3.0 | 16.4 |
| 4/24 | 4 | Ground Run 6000 RPM | 3.1 | 8.2 | 9.5 | 5.8 | 3.4 | 2.0 | 15.0 |
| 4/24 | 4 | Straight & Level - 70K | 4.5 | 7.5 | 13.5 | 7.5 | 4.6 | 3.0 | 18.0 |

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SECTION B (Cont'd.)

| | FLIGHT TES | FLIGHT TEST DATA - ALARM TRANBM | IBEION BA | Transmission base vibration (Cont'd.) | VTION (Co | ot*d.) | DATA R | DATA RECORDED IN G'S (PK) | IN G's |
|---|------------|---------------------------------|-----------|---------------------------------------|-------------|--------|---------|------------------------------|--------|
| | DATE | ATTITUDE | 1-2KC | 2 -4 KC | 4-8KC | 8-12KC | 12-16KC | 16-20KC | ALL |
| | 5/4 | Straight & Lovel – 70K | 3.0 | 7.5 | 7.5 | 5.1 | 2.7 | 1.5 | 11.2 |
| | 2/2 | Climb 500'/Minute | 1.9 | 5.3 | 0.6 | 8.8 | 3.8 | 2.8 | 12.6 |
| | 9/9 | Hover | 2.0 | 0.3 | 2.6 | 0.7 | 3.4 | 2.0 | 12.8 |
| 1 | 5/6 | Hover | 1.6 | 5.3 | 9.7 | 6.8 | 7.4 | 8.8 | 11.2 |
| 0 | 5/8 | Auto-Rotation | | | | | | | 12.8 |
| | 9/9 | Maximum Takeoff | | | | | | | 12.0 |
| | 9/9 | Right Turn | | | | | | | 7.5 |
| | 9/9 | Left Turn | | | | | | | 8.6 |
| | 5/6 | Straight & Level - 105K | | | | | | | 14.2 |
| | 5/9 | Ground Run 6000 RPM | 2.8 8 | 7.4 | 8. 6 | 5.6 | 3.4 | 2.2 | 13.5 |
| | 6/9 | Auto-Rotation | | | | | | | 15.0 |
| - | | | | | | | | | |

SECTION B (Cont'd.)

| FLIGHT TE | FLIGHT TEST DATA - ALARM TRANSM | TRANSMISSION BASE VIBRATION (Cont'd.) | SE VIBRA | TION (Co | nt'd.) | DATA RI | DATA RECORDED IN G'S (PK) | IN G's |
|-----------|---------------------------------|---------------------------------------|----------|----------|--------|---------|------------------------------|--------|
| DATE | ATTITUDE | 1-2KC | 2-4KC | 4-8KC | 8-12KC | 12-16KC | 16-20KC | ALL |
| 6/2 | Right Turn | | | | | | | 18.0 |
| 6/9 | Left Turn | | | | | | | 17.2 |
| 5/9 | Straight & Level - 100K | | | | | | | 18.0 |
| 6/5 | Straight & Level - 70K | 3.4 | 7.5 | 12.8 | 7.5 | 4.6 | 3.4 | 18.0 |
| 6/5 | Straight & Level - 100K | | | | | | | 19.5 |
| 6/5 | Straight & Level - 70K | 3.6 | 7.5 | 13.2 | 7.5 | 5.1 | 3.4 | 16.5 |
| 9/9 | Ground Run (6000) | 3.0 | 7.5 | 9.0 | 5.9 | 3.9 | 2.65 | 14.0 |
| 9/9 | Ground Run (6400) | 3.2 | 8.5 | 11.0 | 7.1 | 4.1 | 2.85 | 16.0 |
| 9/9 | Straight & Level - 80K | 3.6 | 7.3 | 12.0 | 7.5 | 4.5 | 3.4 | 17.0 |
| 9/9 | Climb 500'/Mınute | 8. 8. | 4.8 | 11.0 | 7.1 | 4.1 | 3.3 | 17.5 |
| 9/9 | Climb 2500'/Minute | | | | | | | 19.0 |
| | | | | | | | | |

SECTION B (Cont'd.)

| | FLIGHT TES | FLIGHT TEST DATA – ALARM TRANBM | TRANSMISSION BASE VIBRATION (Cont'd.) | SE VIBRA | TION (Co | nt'd.) | DATA RI | DATA RECORDED IN G'S (PK) | IN G's |
|---|------------|---------------------------------|---------------------------------------|----------|----------|--------|---------|------------------------------|--------|
| | DATE | ATTITUDE | 1-2KC | 2-4KC | 4-8KC | 8-12KC | 12-16KC | 16-20KC | ALL |
| | 6/6 | Hover | 3.6 | 7.5 | 13 | 7.5 | 4.5 | 3.4 | 17 |
| | 6/7 | Hover | 3.4 | 7.1 | 12 | 6.4 | 3.8 | 2.5 | 15.8 |
| | 9/9 | Hover W 1000 # Load | 3.8 | 7.5 | 12.8 | 7.5 | 4.5 | 2.85 | 18 |
| 1 | 6/7 | Hover ₩ 1000 # Load | 3.8 | 7.5 | 16.3 | 7.5 | 4.5 | 2.85 | 20 |
| 2 | 6/7 | Straight & Level - 70-80K | 3.4 | 7.5 | 11.2 | 7.5 | 4.5 | 3.8 | 17 |
| | 6/7 | Straight & Level - 90K | 3.8 | 7.8 | 12.3 | 7.5 | 4.5 | 3.4 | 18 |
| | 8/9 | Straight & Level - 70-80K | 3.5 | 7.5 | 12 | 7.5 | 4.5 | 3.4 | 17.5 |
| 1 | 8/9 | Straight & Level - 100K | 3.8 | 7.5 | 12.3 | 7.5 | 4.9 | 3.2 | 18 |
| 1 | 8/9 | Ground Run 6400 RPM | 3.15 | 7.8 | 10.5 | 6.8 | 3.8 | 3.0 | 15.8 |
| | 6/9 | Ground Run 6400 RPM | 3.15 | 8.2 | 12 | 7.5 | 4.2 | 2.85 | 17 |
| | 6/7 | Right Turn | | | | | | | 18 |

SECTION B (Cont'd.)

| | FLIGHT TES | FLIGHT TEST DATA - ALARM TRANSM | ISSION BA | TRANSMISSION BASE VIBRATION (Cont ⁱ d.) | TION (Co | nt'd.) | DATA R | DATA RECORDED IN G'S (PK) | IN G's | |
|-------------|------------|---------------------------------|-----------|--|----------|--------|---------|------------------------------|--------|---|
| | DATE | ATTITUDE | 1-2KC | 2-4KC | 4-8KC | 8-12KC | 12-16KC | 16-20KC | ALL | |
| | 2/9 | Left Turn | | | | | | | 16.5 | |
| 1 | 6/7 | Maximum Takeoff | | | | | | | 24 | |
| _ | 2/9 | Auto-Rotation | | | | | | | 15 | |
| | 6/9 | Maximum Takeoff | | | | | | | 22.5 | |
| | 6/9 | Climb 2500'/Minute | | | | | | | 18.7 | |
| | 6/13 | Hover W 1000 # Load | 3.5 | 7.5 | 14.2 | 7.5 | 4.1 | 2.6 | 16.5 | • |
| | 6/14 | Straight & Level - 70-80K | | | | | | | 16.5 | |
| | 6/14 | Straight & Level - 90-100K | | | | | - | | 18.7 | |
| | 6/14 | Climb 500'/Minute | | | | | | | 18 | • |
| | 6/14 | Climb 2500'/Minute | | | , | | | , | 17.2 | |
| | 6/14 | Maneuver Right Turn | | | | | | | 18 | |
| | | | | | | | | | CPHBOS | |

SECTION B (Contid.)

| FLIGHT TE | FLIGHT TEST DATA - ALARM TRANSM | TRANSMISSION BASE VIBRATION (Cont'd.) | SE VIBRA | TION (Co | :t'd.) | DATA RI | DATA RECORDED IN G'S (PK) | IN G's |
|-----------|---------------------------------|---------------------------------------|----------|----------|--------|---------|------------------------------|--------|
| DATE | ATTITUDE | 1-2KC | 2-4KC | 4-8KC | 8-12KC | 12-16KC | 16-20KC | ALL |
| 6/14 | Maneuver Left Turn | | | | | | | 17.2 |
| 6/14 | Auto-Rotation | | | | | | | 15 |
| 6/14 | Maximum Takeoff | | | | | | | 19.5 |
| 6/14 | Straight & Level - 70-80K | | | | | | | 17.2 |
| 6/14 | Straight & Level - 90-100K | | | | | | | 18.7 |
| 6/16 | Ground Run 6400 RPM | | • | | | | | 16.5 |
| 6/16 | Hover | | | | | | | 15.8 |
| 91/9 | Hover W 1000 # Load | | | | | | | 19.5 |
| 6/16 | Hover @ 2000' MBL | | | | i | | | 18 |
| | | | | ļ | | | | |
| | | | | | | | | |

SECTION C

| Si [| FLIGHT TEST DATA - ALARM AF | AFT ENGINE VIBRATION | VIBRATIO | z | DATA VI | A RECORDED AS VE VELOCITY (IN/SEC) | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | TOR | |
|------|-----------------------------|----------------------|----------|--------------------|------------|---------------------------------------|--|------|-------------|
| | ATTITUDE | $10-20$ \sim | 20-40 ℃ | 20 -4 0 | 80-160 | 160-320 | 320-500 | ALL | |
| Gro | Ground Run 5800 RPM | 0.2 | 0.30 | 0.15 | 0.1 | 0.3 | 0.27 | 0.73 | 7 6 4 |
| Gre | Ground Run 5800 RPM | 0.49 | 0.44 | 0.30 | 0.25 | 0.3 | 0.4 | 0.8 | |
| Str | Straight & Level - 70K | 0.29 | 0.48 | 0.29 | 0.19 | 0.68 | 0.37 | 1.2 | |
| Str | Straight & Level - 80K | 0.19 | 0.48 | 0.24 | 0.19 | 0.29 | 0.73 | 0.89 | |
| ซ | Climb 500'/Minute | 0.24 | 0.34 | 0.20 | 0.22 | 0.82 | 96.0 | 1.5 | ; |
| ซ | Climb 500'/Minute | 0.24 | 0.39 | 0.17 | 0.20 | 0.70 | 1.0 | 1.5 | : |
| ប | Climb 2500'/Minute | | | | | | | 2.0 | |
| 82 | Straight & Level - 70K | 0.39 | 0.54 | 0.49 | 0.44 | 0.59 | 0.78 | 1.4 | |
| 윮 | Hover | 0.49 | 0.54 | 0.44 | 0.44 | 0.78 | 1.02 | 1.8 | |
| 5 | Ground Run 6000 RPM | 0.17 | 0.32 | 0.11 | 0.10 | 0.27 | 0.32 | 0.7 | |
| Str | Straight & Level - 70K | 0.29 | 0.54 | 0.29 | 0.17 | 0.63 | 1.04 | 1.57 | |
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| | FLIGHT TES | FLIGHT TEST DATA - ALARM AFT ENGINE VIBRATION (Cont'd) | NE VIBRA | TION (Co | nt'd) | DATA DATA | A RECORDED AS VE VELOCITY (IN/SEC) | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | ror |
|-----------|------------|--|----------|----------|---------|-----------|---------------------------------------|--|------|
| | DATE | ATTITUDE | ~07-01 | 20-40~ | 40-80 ∼ | 80-160 | 160-320 | 320-500 | ALL |
| L | 5/4 | Straight & Level - 70K | 0.39 | 0.37 | 0.29 | 0.22 | 0.59 | 0.83 | ê. |
| | 5/5 | Climb 500'/Minute | 0.22 | 0.42 | 0.17 | 0.21 | 0.68 | 0.93 | 1.56 |
| · | 5/5 | Hover | 0.27 | 0.39 | 0.17 | 0.24 | 0.77 | 0.49 | 1.7 |
| 16 | 5/6 | Hover | 0.32 | 0.44 | 0.39 | 0.29 | 0.73 | 1.0 | 1.6 |
| ; | 5/6 | Auto-Rotation | | | | | | | 0.73 |
| <u></u> _ | 5/6 | Maximum Takeoff | | | | | | | 1.95 |
| · | 5/6 | Right Turn | | | | | | | 1.22 |
| | 5/6 | Left Turn | | | | | | | 1.22 |
| L | 5/6 | Straight & Level - 100K | | | | | | | 1.7 |
| | 5/9 | Ground Run 6000 RPM | 0.135 | 0.27 | 0.105 | 0.155 | 0.32 | 0.28 | 0.66 |
| | 5/9 | Auto-Rotation | | | | | | | 0.83 |

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| | FLIGHT TE | FLIGHT TEST DATA - ALARM AFT | ENGINE | AFT ENGINE VIBRATION (Cont'd) | N (Cont'd) | | A RECORDED AS VE VELOCITY (IN/SEC) | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | TOR |
|---------|-----------|------------------------------|---------|-------------------------------|------------|--------|---------------------------------------|--|------|
| | DATE | ATTITUDE | 10-20 ∼ | 20-40 ∼ | 40-80 ∼ | 80-160 | 160-320 | 320-500 | ALL |
| | 6/9 | Right Turn | | | | | | | 1.6 |
| | 6/2 | Left Turn | | | | | | | 1.4 |
| <u></u> | 9/6 | Straight & Level - 100K | | | | | | | 1.65 |
| 17 | 6/5 | Straight & Level - 70K | 0.24 | 0.23 | 0.22 | 0.29 | 0.61 | 0.85 | 1.35 |
| | 6/5 | Straight & Level - 100K | | | | | | i i | 1.65 |
| | 9/9 | Ground Run 6000 RPM | < 0.1 | 0.11 | 0.1 | 0.15 | 0.31 | 0.31 | 0.54 |
| | 9/9 | Ground Run 6400 RPM | 0.1 | 0.14 | 0.1 | 0.19 | 0.46 | 0.44 | 0.80 |
| L | 9/9 | Straight & Level - 80K | 0.15 | 0.2 | 0.16 | 0.22 | 0.68 | 0.78 | 1.3 |
| | 9/9 | Straight & Level - 80K | 0.15 | 0.22 | 0.18 | 0.23 | 0.68 | 0.88 | 1.35 |
| | 9/9 | Climb 500'/Minute | 0.13 | 0.22 | 0.15 | 0.20 | 0.70 | 0.92 | 1.5 |
| | 9/9 | Climb 2500'/Minute | | | | | | | 1.2 |

SECTION C (Cont'd.)

| | FLIGHT TE | FLIGHT TEST DATA - ALARM AFT ENC | SINE VIBE | AFT ENGINE VIBRATION (Cont'd) | ont'd) | DATA | A RECORDED AS VI VELOCITY (IN/SEC) | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | TOR |
|----|-----------|----------------------------------|-----------|-------------------------------|---------|--------|---------------------------------------|--|------|
| • | DATE | ATTITUDE | 10-20 ∼ | 20-40 ∼ | 40-80 ∼ | 80-160 | 160-320 | 320-500 | ALL |
| | 9/9 | Hover | 0.49 | 0.195 | 0.1 | 0.22 | 0.68 | 96.0 | 1.35 |
| | 2/9 | Hover | 0.12 | 0.17 | 0.11 | 0.195 | 0.7 | 0.98 | 1.4 |
| | 9/9 | Hover W 1000 # Load | 0.29 | 0.195 | 0.125 | 0.24 | 0.62 | 0.98 | 1.4 |
| 18 | 2/9 | Hover W 1000 # Load | 0.195 | 0.195 | 0.12 | 0.22 | 0.65 | 1.08 | 1.65 |
| | 6/7 | Straight & Level - 70K | < 0.1 | 0.17 | 0.17 | 0.24 | 0.63 | 0.78 | 1.3 |
| | 1,79 | Straight & Level - 90K | < 0.1 | 0.27 | 0.17 | 0.24 | 0.73 | 1.02 | 1.57 |
| | 8/9 | Straight & Level - 70-80K | 0.195 | 0.195 | 0.17 | 0.245 | 0.65 | 0.83 | 1.35 |
| | 8,9 | Straight & Level - 100K | | | | | | | 1.7 |
| k | 6/8 | Ground Run 6400 RPM | 0.1 | 0.1 | < 0.1 | 0.195 | 0.34 | 0.34 | 0.66 |
| | 6,9 | Ground Run 6400 RPM | < 0.1 | 0.12 | 0.11 | 0.195 | 0.365 | 0.34 | 0.65 |
| | 6/7 | Ri ght Turn | | | | | | | 1.45 |
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| <u> </u> | LIGHT TES | FLIGHT TEST DATA - ALARM AFT EN | IGINE VIB | AFT ENGINE VIBRATION (Cont'd) | Cont'd) | DATA I | A RECORDED AS VE VELOCITY (IN/SEC) | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | ror |
|----------|-----------|---------------------------------|-----------|-------------------------------|---------|--------|---------------------------------------|--|------|
| | DATE | ATTITUDE | ~02-01 | ~07-02 | ~08-0₹ | 80-160 | 160-320 | 320-500 | ALL |
| | 2/9 | Left Turn | | | | | | | 1.45 |
| | 6/7 | Maximum Takeoff | | | | | | | 1.85 |
| | 6,7 | Auto-Rotation | | | | | | | 0.83 |
| 1: | 6/9 | Maximum Takeoff | | | | | | | 1.6 |
| | 6/9 | Climb 2500'/Minute | | | , | | | | 1.22 |
| | 6/13 | Hover W 1000 # Load | 62.3 | 0.17 | 0.145 | 0.195 | 0.64 | 96.0 | 1.45 |
| | 6/14 | Straight & Level - 70-80K | | | | | | | 1.45 |
| | 6 /14 | Straight & Level - 90-100K | | | | | | | 1.65 |
| | 6/14 | Climb 500'/Minute | | | | | | | 1.5 |
| | 6/14 | Climb 2500'/Minute | | | | | | | 1.21 |
| | 6/14 | Right Turn | | | | | | | 1.31 |

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SECTION C (Cont'd.)

| 1 | | | | | | <u>'</u> | ! | | | | | 15 |
|--|----------|-----------|---------------|-----------------|---------------------------|----------------------------|---------------------|-------|---------------------|-------------------|------|-------|
| ror | ALL | 1.35 | 0.83 | 1.65 | 1.31 | 1.65 | 0.83 | 1.22 | 1.45 | 1.45 | | CPHED |
| DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | 320-500 | | | | | | | | | , | | |
| A RECORDED AS VE VELOCITY (IN/SEC) | 160-320 | | | | | | | · | | | | |
| DATA VI | 80-160 | | | | | | | | | | | |
| (Cont'd) | ~ 08-07 | | | | | | | | | | | |
| AFT ENGINE VIBRATION (Cont'd) | 20-40 ∼ | | | | | | | | · | | | |
| ENGINE V | 10-20 ∼ | | | | | | | | | | | |
| FLIGHT TEST DATA - ALARM AFT | ATTITUDE | Left Turn | Auto-Rotation | Maximum Takeoff | Straight & Level - 70-80K | Straight & Level - 90-100K | Ground Run 6400 RPM | Hover | Hover W 1000 # Load | Hover @ 2000' MSL | | |
| FLIGHT TES | DATE | 6/14 | 6/14 | 6/14 | 6/14 | 6/14 | 91/9 | 91/9 | 6/16 | 6/16 | | |

| FLIGHT TE | FLIGHT TEST DATA - ALARM FW | FWD ENGINE VIBRATION | VIBRATI | NO | DATA R | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | AS VECT | ror |
|-----------|-----------------------------|----------------------|--|---------------|--------|--|---------|------|
| DATE | ATTITUDE | 10-20 | 10-20 20-40 C 20-40 C 20-40 | 40-80~ 80-160 | 80-160 | 160-320 | 320-500 | ALL |
| 3/3 | Ground Run 5800 RPM | 0.15 | 0.25 | 0.1 | 0.12 | 0.22 | 0.3 | 1.0 |
| 3/8 | Ground Run 5800 RPM | 0.44 | 0.3 | 0.25 | 0.25 | 0.3 | 0.34 | 0.59 |
| 3/10 | Straight & Level - 70E | 0.97 | 0.53 | 0.29 | 0.17 | 0.44 | 0.34 | 0.63 |
| 3/11 | Straight & Level - 80K | 0.54 | 0.48 | 0.19 | 0.15 | 0.15 | 0.34 | 0.54 |
| 3/11 | Climb 500'/Minute | 0.64 | 0.49 | 0.12 | 0.17 | 0.49 | 0.59 | 1.5 |
| 3/11 | Climb 500'/Minute | 0.64 | 0.49 | 0.15 | 0.17 | 0.44 | 0.54 | 1.5 |
| 3/11 | Climb 2500'/Minute | | | | | | | 1.9 |
| 4/21 | Straight & Level - 70K | 0.88 | 0.64 | 0.44 | 0.44 | 0.49 | 0.49 | 1.2 |
| 4/21 | Hover | 0.98 | 0.49 | 0.49 | 0.44 | 0.54 | 0.64 | 1.46 |
| 4/24 | Ground Run 6000 RPM | 0.11 | 0.17 | 0.11 | 0.11 | 0.24 | 0.365 | 0.64 |
| 4/24 | Straight & Level - 70K | 0.68 | 0.48 | 0.165 | 0.195 | 0.44 | 0.63 | 1.45 |

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SECTION D (Cont'd)

| FLIGHT TE | FLIGHT TEST DATA - ALARM FWD ENG | GINE VIBE | FWD ENGINE VIBRATION (Cont'd) | ont'd) | DATA I | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | D AS VEC IN/SEC) | ror |
|-----------|----------------------------------|-----------|-------------------------------|---------------|--------|--|---------------------|-------|
| DATE | ATTITUDE | 10-20℃ | 10-20~ 20-40~ | 40-80~ 80-160 | | 160-320 | 320-500 | ALL |
| 5/4 | Straight & Level - 70K | 0.44 | 0.44 | 0.32 | 0.195 | 0.39 | 0.48 | 1.1 |
| 5/2 | Climb 500'/Minute | 0.59 | 0.39 | 0.145 | 0.23 | 0.47 | 0.63 | 1.2 |
| 5/5 | Hover | 0.22 | 0.29 | 0.13 | 0.21 | 0.46 | 0.63 | 1.0 |
| 9/9 | Hover | 0.49 | 0.34 | 0.39 | 0.34 | 0.39 | 0.54 | 0.73 |
| 9/9 | Auto-Rotation | | | | | | | 0.63 |
| 2/6 | Maximum Takeoff | | | | | | | 1.6 |
| 2/6 | Right Turn | | | | | | | 0.63 |
| 9/9 | Left Turn | | | | | | | 1.6 |
| 5/6 | Straight & Level - 100K | | | | | | | 1.31 |
| 6/9 | Ground Run 6000 RPM | 0.1 | 0.145 | 0.1 | 0.17 | 0.29 | 0.37 | 0. 59 |
| 5/9 | Auto-Rotation | | | | | | | 0.54 |
| | | | | | | | | |

SECTION D (Cont'd.)

| FLIGHT | FLIGHT TEST DATA - ALARM FWD | ENGINE | FWD ENGINE VIBRATION (Cont'd) | ON (Cont'd | | A RECORDED AS VE VELOCITY (IN/SEC) | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | TOR |
|--------|------------------------------|--------|-------------------------------|------------|--------|---------------------------------------|--|--------------|
| DATE | ATTITUDE | ~07-01 | 20-40 ∿ | ~08-0₹ | 80-160 | 160-320 | 320-500 | ALL |
| 5/9 | Right Turn | | | | | | | 1.2 |
| 6/9 | Left Turn | | | | | | · | 1.1 |
| 6/9 | Straight & Level - 100K | | | | | | | 1.35 |
| 6/5 | Straight & Level - 70K | 0.83 | 0.54 | 0.19 | 0.22 | 0.34 | 0.44 | 1.45 1.55 |
| 6/5 | Straight & Level - 100K | | | | | | | 2.3 |
| 9/9 | Ground Run (6000) | < 0.1 | <0.1 | 0.11 | 0.17 | 0.22 | 0.32 | 0.49 |
| 9/9 | Ground Run (6400) | 0.1 | 0.12 | 0.12 | 0.21 | 0.22 | 0.24 | 0.49 |
| 9/9 | Straight & Level - 80K | 0.88 | 0.49 | 0.16 | 0.22 | 0.44 | 0.49 | 1.6 |
| 9/9 | Straight & Level - 80K | 0.88 | 0.56 | 0.17 | 0.22 | 0.44 | 0.59 | 1.65 |
| 9/9 | Climb 5001/Minute | 0.88 | 0.34 | 0.15 | 0.21 | 0.44 | 0.56 | 1.4 |
| 9/9 | Climb 2500'/Minute | | | | | | | 1.3 |
| | | | | | | | | |

SECTION D (Cont'd)

| | FLIGHT TES | FLIGHT TEST DATA - ALARM FWD I | FWD ENGINE VIBRATION (Cont'd) | BRATION | (Cont'd) | DATA | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | ED AS VE((IN/SEC) | TOR |
|----|------------|--------------------------------|-------------------------------|--------------|----------------|--------|--|-----------------------|-----------|
| | DATE | ATTITUDE | 10-20℃ | 10-20~20-40~ | 4 0-80℃ | 80-160 | 160-320 | 320-500 | ALL |
| | 9/9 | Hover | 0.44 | 0.195 | 0.120 | 0.21 | 0.44 | 0.56 | 0.98 |
| | 6/7 | Hover | 0.195 | 0.145 | 0.11 | 0.195 | 0.46 | 0.58 | 0.98 |
| | 9/9 | Hover W 1000 # Load | 0.24 | 0.22 | 0.117 | 0.185 | 0.41 | 0.62 | 1,18 |
| 2 | 2/9 | Hover W 1000 # Load | 0.24 | 0.195 | 0.12 | 0.195 | 0.52 | 0.78 | 1.25 |
| 24 | 6/7 | Straight & Level - 70K | 0.73 | 0.49 | 0.155 | 0.22 | 0.39 | 0.49 | 1.45 |
| | 2/9 | Straight & Level - 90K | 0.98 | 0.69 | 0.17 | 0.22 | 0.46 | 0.63 | 1.95 |
| | 8/9 | Straight & Level 70-80K | 0.78 | 0.49 | 0.137 | 0.205 | 0.44 | 0.58 | 1.57 |
| | 8/9 | Straight & Level - 100K | | | | | | | 2.2 |
| | 8/9 | Ground Run 6400 RPM | < 0.1 | 0.1 | 0.12 | 0.195 | 0.205 | 0.265 | 0.56 |
| | 6/9 | Ground Run 6400 RPM | < 0.1 | 0.1 | 0.11 | 0.18 | 0.215 | 0.28 | 0.49 |
| | 6/7 | Right Turn | | | | | | | 1.45 |
| | | | | | | | | | 308 ii 45 |

SECTION D (Cont'd)

| | FLIGHT TES | FLIGHT TEST DATA - ALARM FWD EN | GINE VIB | FWD ENGINE VIBRATION (Cont'd) | Cont'd) | DATA R | ECORDED OCITY (IN | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | OR |
|---------------|------------|---------------------------------|----------|-------------------------------|---------|--------|----------------------|---|-------|
| <u> </u> | DATE | ATTITUDE | ℃07-01 | 20-40℃ | 40-80℃ | 80-160 | 160-320 | 320-500 | ALL |
| | 1/9 | Left Turn | | | | | | | 1.35 |
| - | 6/7 | Maximum Takeoff | | | | | | | 1.65 |
| <u> </u> | 6/7 | Auto-Rotation | | | | | | | 0.54 |
| | 6/9 | Maximum Takeoff | | | | | | | 1.47 |
| 25 | 6/9 | Climb 2500'/Minute | | | | | | | 1.12 |
| <u></u> | 6/12 | Hover W 1000 # Load | 0.29 | 0.195 | 0.13 | 0.17 | 0.46 | 0.69 | 1.12 |
| | 6/14 | Straight & Level - 70-80K | | · | | | | | 1.21 |
| | 6/14 | Straight & Level - 90-100K | | | | · | | | 1.85 |
| | 6/14 | Climb 500'/Minute | | | | | | | 1:,95 |
| | 6/14 | Climb 2500'/Minute | | | | | | | 1.6 |
| | 6/14 | Right Turn' | | _ | | | | · | 1.31 |

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SECTION D (Cont'd)

| DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | 160-320 320-500 ALL | 1, 55 | 0.49 | 1.7 | 1.45 | 1.95 | 0.52 | 0.78 | 1.08 | 1.31 | | CPHBOZ |
|--|---------------------|-----------|---------------|-----------------|---------------------------|----------------------------|---------------------|-------|---------------------|-------------------|---|--------|
| DA | 80-1 | | | | | | | | | | | |
| (Cont'd) | 40-80℃ | | | | | | | | | | | |
| BRATION | , 20-40℃ | | | | | | | | | | į | |
| FWD ENGINE VIBRATION (Cont'd) | 10-20℃ | | | | | | | | | | | |
| FLIGHT TEST DATA - ALARM FWD F | ATTITUDE | Left Turn | Auto-Rotation | Maximum Takeoff | Straight & Level - 70-80K | Straight & Level - 90-100K | Ground Run 6400 RPM | Hover | Hover W 1000 # Load | Hover @ 2000' MSL | | |
| FLIGHT TES | DATE | 6/14 | 6/14 | 6/14 | 6/14 | 6/14 | 6/16 | 6/16 | 91/9 | 6/13 | | |

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| FLIGHT TE | FLIGHT TEST DATA - ALARM | TAIL VIBRATION | ATION | | DATA RE VELC | DATA RECORDED AS VECFOR VELOCITY (IN/SEC) | AS VECTO (SEC) | & |
|-----------|--------------------------|----------------|---------------|--------|-----------------|--|-------------------|--------------|
| DATE | ATTITUDE | 10-20℃ | 20-40~ 40-80~ | ~08-0₹ | 80-160 | 160-320 | 320-500 | ALL |
| 3/3 | Ground Run 5800 RPM | 0.24 | 0.39 | 1.0 | 6.0 | 0.5 | 0.39 | 1.5 |
| 3/8 | Ground Run 5800 RPM | 0.49 | 0.49 | 0.54 | 0.64 | 0.44 | 0.39 | 1.2 |
| 3/10 | Straight & Level - 70K | 0.77 | 1.2 | 1.5 | 1.5 | 0.73 | 0.4 | 2.4 |
| 3/11 | Straight & Level - 80K | 0.48 | 1.2 | 1.5 | 1.5 | 0.64 | 0.39 | 1.9 |
| 3/11 | Climb 500'/Minute | 0.49 | 98.0 | 1.2 | 1.5 | 0.64 | 0.49 | 2.4 |
| 3/11 | Climb 500'/Minute | 0.49 | 0.59 | 1.1 | 1.5 | 0.64 | 0.39 | 2.6 |
| 3/11 | Climb 2500'/Minute | | | | | | | 2.4 |
| 4/21 | Straight & Level - 70K | 0.49 | 1.02 | 1.21 | 1.7 | 0.73 | 0.54 | 2.4 |
| 4/21 | Hover | 0.49 | 0.98 | 0.98 | 1.37 | 1.18 | 0.58 | 2.53 |
| 4/24 | Ground Run 6000 RPM | 0.13 | 0.34 | 0.78 | 0.78 | 0.49 | 0.32 | 1.2 |
| 4/24 | Straight & Level - 70K | 0.54 | 0.98 | 1.17 | 1.55 | 0.63 | 0.4 | 2.3 |

SECTION E

| (Cont'd) | |
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| FLIGHT TES | FLIGHT TEST DATA - ALARM TAI | IL VIBRAT | TAIL VIBRATION (Cont'd) | 'd) | DATA | ca recorded as vi Velocity (IN/Sec) | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | CTOR |
|------------|------------------------------|-----------|-------------------------|--------|--------|--|--|-------|
| DATE | ATTITUDE | 10-20C | 20-40℃ | 40-80℃ | 80-160 | 160-320 | 320-500 | ALL |
| 5/4 | Straight & Level 70K | 0.48 | 0.73 | 0.83 | 1.27 | 0.48 | 0.38 | 1,95 |
| 5/2 | Climb 500'/Minute | 0.44 | 0.78 | 1.03 | 1.45 | 0.63 | 0.37 | 2.4 |
| 5/2 | Hover | 0.34 | 0.59 | 0.85 | 1.45 | 0.77 | 0.54 | 2.4 |
| 9/9 | Hover | 0.24 | 0.44 | 0.97 | 1.45 | 0.73 | 0.73 | 2.4 |
| 9/9 | Auto-Rotation | | | | | | | 1.95 |
| 5/6 | Maximum Takeoff | | | | | | | 1.95 |
| 2/6 | Right Turn | | | | | | | 2.2 |
| 9/9 | Left Turn | | | | | | | 2. 43 |
| 9/9 | Straight & Level 100K | | | | | | | 2.7 |
| 6/9 | Ground Run 600¢ RPM | 0.11 | 0.32 | 0.63 | 0.86 | 0.56 | 0.27 | 1.3 |
| 5/9 | Auto-Rotation | | | | | | | 1.95 |

SECTION E (Cont'd)

| | LIGHT TES | FLIGHT TEST DATA - ALARM TAI | L VIBRAT | TAIL VIBRATION (Cont'd) | . | DATA | ra recorded as vi velocity (in/sec) | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | TOR |
|---|-----------|------------------------------|-----------------|-------------------------|---------------|--------|--|--|------|
| | DATE | ATTITUDE | ~07-01 | 20-40℃ | 40-80~ 80-160 | 80-160 | 160-320 | 320-500 | ALL |
| | 6/9 | Right Turn | | | | | | | 2.05 |
| 1 | 5/9 | Left Turn | | | · | | | | 2.45 |
| | 6/9 | Straight & Level - 100K | | | | | | | 2.4 |
| 2 | 6/5 | Straight & Level - 70K | 0.59 | 0.61 | 0.78 | 1.2 | 0.56 | 0.42 | 2. |
| 9 | 6/5 | Straight & Level - 100K | | | | | | | 8,8 |
| | 6/5 | Straight & Level - 70K | < 0.1 | 0.63 | 0.83 | 1.2 | 0.48 | 0.34 | 1.9 |
| | 9/9 | Ground Run (6000) | 0.11 | 0.27 | 0.61 | 0.78 | 0.59 | 0.44 | 1.35 |
| | 9/9 | Ground Run (6400) | 0.15 | 0.34 | 0.76 | 1.0 | 0.49 | 0.44 | 1.45 |
| | . 9/9 | Straight & Level - 80K | 0.41 | 0.68 | 0.88 | 1.2 | 0.56 | 0.34 | 2.0 |
| | 9/9 | Straight & Level - 80K | 0.44 | 0.68 | 0.88 | 1.1 | 0.56 | 0.39 | 2.0 |
| | 9/9 | Climb 500'/Minute | 0.39 | 0.73 | 0.75 | 1.2 | 0.54 | 0.32 | 1.8 |

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| FLIGHT TE | FLIGHT TEST DATA - ALARM TAI | TAIL VIBRATION (Cont'd) | ION (Cont | (g | DATA VE | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | D AS VEC | TOR |
|-----------|------------------------------|-------------------------|-----------|------------|------------|---|----------|------------|
| DATE | ATTITUDE | 10-20℃ | 20-40℃ | 40-80℃ | 80-160 | 160-320 | 320-500 | ALL |
| 9/9 | Climb 2500'/Minute | | | | | | | 2.6 |
| 9/9 | Hover | 0.17 | 0.29 | 0.8 | 1.45 | 0.78 | 0.49 | 2.2 |
| 1/9 | Hover | 0.22 | 0.39 | 0.78 | 1.2 | 0.73 | 0.49 | 1.86 |
| 9/9 | Hover W 1000 # Load | 0.32 | 0.29 | 0.98 | 1.95 | 1.25 | 0.78 | 2.9 |
| 2/9 | Hover W 1000 # Load | 0.17 | 0.34 | 0.88 | 1.93 | 1.25 | 0.73 | 2.4 |
| 2/9 | Straight & Level - 70K | 0.39 | 0.59 | 0.73 | 1.2 | 0.54 | 0.34 | 1.95 - 2.4 |
| 1/9 | Straight & Level - 90K | 0.39 | 0.83 | 0.83 | 1.3 | 0.58 | 0.34 | 1.95 - 2.4 |
| 8/9 | Straight & Level - 70-80K | 0.44 | 0.58 | 0.78 | 1.3 | 0.58 | 0.34 | 2.2 |
| 8/9 | Straight & Level - 100K | | | | | | | 2.4 |
| 8/9 | Ground Run 6400 RPM | < 0.1 | 0.22 | 0.59 | 0.93 | 0.49 | 0.34 | 1.36 |
| 6/9 | Ground Run 6400 RPM | 0.12 | 0.24 | 0.68 | 1.02 | 0.54 | 0.4 | 1.45 |
| | | | | | | | | |

SECTION E (Cont'd.)

| | | VIBRATI | 20 | o o | DATA R VEI | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | AS VECT N/SEC) 320-500 | OR |
|------------------|---------------------|---------|--------|---------|---------------|---|---|--------|
| | ATTITUDE | 10-20 ∼ | 20-40~ | 40-80 ∼ | 80-160 | 160-320 | 320-500 | ALL |
| Right Turn | | | | | | | | 1.95 |
| Left Turn | | | | | | ; | | 2.2 |
| Maximum Takeoff | Takeoff | | | | | | 3 8 4 5 7 9 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 2.4 |
| Auto-Rotation | ation | | , | | | | | 1.45 |
| Maximum Takeoff | . Takeoff | | | | | | | 2.2 |
| Climb 25 | Climb 2500'/Minimum | | | | | | | 2.1 |
| Hover W 1000 # | 1000 # Load | 0.34 | 0.39 | 0.78 | 1.57 | 0.93 | 9.59 | 2.2 |
| Straight & Level | & Level 70-80K | | | | | | | 1.95 |
| Straight & Level | & Level - 90-100K | | | | | | | 2.2 |
| Climb 50 | Climb 500'/Minute | | | | | | | 1.8 |
| Climb 2 | Climb 2500'/Minute | , | | | | | | 2.2 |
| | | | | | | | | CPIEDS |

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the second

), *

SECTION E (Cont'd.)

| SE | FLIGHT TEST DATA - ALARM TAII | C VIBRAT | TAIL VIBRATION (Cont'd.) | d.) | DATA | RECORDE LOCITY (| DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | TOR |
|----|-------------------------------|--------------------------|--------------------------|-----------------|--------|---------------------|--|--------|
| | ATTITUDE | 10-20 ~ 20- 4 0 ~ | | 4 0−80 ~ | 80-160 | 160-320 | 320-500 | ALL |
| | Right Turn | | | | | | | 2.2 |
| | u.n.L yer | | | | | | | 2.2 |
| | Auto-Rotation | | | | | | | 1.95 |
| | Maximum Takeoff | | | | | | | 2.6 |
| | Straight & Level - 70-80K | | | | | | | 1.95 |
| | Straight & Level - 90-100K | | | | | | | 2.2 |
| | Ground Run 6400 RPM | | * | | · | | | 1.57 |
| | Hover | | | | | | | 1.95 |
| | Hover W 1000 # Load | | | | | | | 2.2 |
| | Hover @ 2000' MSL | | | | | | | 2.9 |
| | Hover @ 3000' MSL | | | | | | | 2.45 |
| - | | | <u> </u> | | | | | CPNEDS |

APPENDIX III

MALFUNCTION TEST DATA *

- A. Transmission Top Vibration
- B. Transmission Base Vibration
- C. Aft Engine Vibration
- D. Forward Engine Vibration
- E. Tail Vibration
- F. Low Frequency Mast Vibration
 - * All malfunction test data were recorded during the period of June 6, 1961, to November 9, 1961.

SECTION A

MALFUNCTION TEST DATA-ALARM TRANSMISSION TOP VIBRATION

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| 7 | آد | | 2 | | | | | o | 68 | 0 |
|-----------------|-----------------|-----------|-----------|------------|-----------|-----------|-----------|---------------------------------------|---------------------------------------|------------------------------------|
| | ALL | 32. | 31.5 | 8 | 30:9 | 29.0 | 29.0 | 30.0 | 28-29 | 27.0 |
| | 12-16kg 16-20kg | 2.7 | 2.8 | 2.3 | | | | | | |
| | 12-10kg | 5.4 | 5.3 | ** | | | | | | |
| May SH | 8-12kc | 10.0 | 9.6 | 0 0 | | | | | | |
| RECORDED IN G'S | 4-8kc | 14.0 | 13.5 | 12.6 | | | | • | | |
| TECORD | 2-4ko | 24.0 | 24.5 | 21.8 | | | | · | | |
| DATA | 1-2kc | 9.6 | 6.3 | 6.1 | | | | | | |
| | . 5-1kc | | | | | | | | | |
| INDIC | NOTED | | | | | | | | | |
| | CONDITION(S) | Reference | Reference | Reference | Reference | Reference | Reference | Main Rotor Out of Track (2 Flate) | Main Rotor Out of Track (3 Flats) | Main Rotor Unbalance (1w. W/Y) |
| | DATE CODE | 1 | 7 | 1 | 1 | 1 | Ħ | . 1. | 1 | ~4 |
| | DATE | 9/9 | 8/9 | 6/9 | 91/9 | 87/9 | 67/9 | 6/2.5 | 67/9 | 67/9 |

MALFUNCTION TEST DATA-ALARMI TRANSMISSION TOP VIBRATION (Cont'd)

| SECT | SECTION A (Cont'd) | Cont'd) | | | MAL FU TRANSI | NCTION | MALFUNCTION TEST DATA-ALARM TRANSMISSION TOP VIBRATION (Con | ATA-AI 3RATIO | MAL FUNCTION TEST DATA-ALARM TRANSMISSION TOP VIBRATION (Cont'd) | <u>-</u> | |
|----------|--------------------|--|-------|--------|------------------|-------------|--|------------------|---|----------|---------|
| | | | INDIC | | DATA | RECORD | DATA RECORDED IN G'S (PK) | S (PK) | | | |
| DAT | DATEICODE | CONDITION(S) | NOTED | .5-1kc | 1-2kc | 2-4kc 4-8kc | 4-8kc | 8-12ko | 8-12kc 12-16kc 16-20kc | 16-20ko | ALL |
| 9 | F-1 | Main Rotor Unbalance (3w. W/Y) | | | | | | | | | 27.0 |
| 6.25 | - | Main Rotor Unbalance (5w. W/Y) | | | | | | | | | 27.0 |
| 6/30 | | Reference | | | | | | | | | 28.0 |
| 0€/9 | - | Damper Out of Time (12 seconds) | | | | No | No Change | | | | |
| 08./9 | | Damper Out of Time (< 1 second) | | | | No | No Change | | | | |
| ეც, ფ | | R. Rear Pylon Mount @ 1/2 Torque (480"#) | | | | | | | | , | 26-27 |
| 9/30 | | Right Rear and Right Front Pylon Mounts @ 1/2 Torque (480"#) | | | | | | | | | 27-28 |
| 6 - 30 | | Short Shaft Misalignment: 15 Shims (≈ .035") Re- moved, L. Rear Eng. Mount | | | | | | | | | 28-29 |
| 6/30 | | Reference | | | | | | | | | 29-30 |
| | | | | | | | | | | | Control |

MALFUNCTION TEST DATA-ALARM TRANSMISSION TOP VIBRATION (Cont'd)

SECTION A (Cont'd)

| ļ | (| | INDIC | | DATA | DATA RECORDED IN G'S (PK) | ED IN G | 'S (PK) | | | |
|----------|--------------|----------------|-------|----------|-------|---------------------------|---------|---------|---------|----------------|--------|
| ᆈ | חיין ד וכטחד | CONDITION(S) | NOTED | .5-1kc | 1-2kc | 2-4kc | 4-8kc | 8-12kc | 12-16ka | 12-16ka16-20kc | ALL |
| | , | | | | | | | | | | |
| 5/3 | - | Reference | | | | | | | | | 28-29 |
| | | | | | | | | | | | |
| 7/5 | 7 | Reference | | | | | | | | | 29 |
| 77.11 | н | Reference | | | | | | | | | 30.5 |
| 2/18 | - | Reference ** | | 1.76 | 5.1 | 17.5 | 24.5 | 9.9 | 2.28 | 1.58 | 28.1 |
| 7/28 | 1 | Reference | | 2.2 | 5.73 | 17.5 | 22.0 | 6.15 | 2.29 | 1.67 | 29.0 |
| 25 | 1 | Reference *** | | 4.85 | 15.8 | 6.15 | 9.7 | 16.7 | 9.7 | 4.4 | 21.1 |
| رن تر | 1 | Reference **** | | 2.64 | 7.05 | 8.35 | 12.3 | 6.15 | 3.52 | 2.2 | 17.6 |
| | | Reference | | ડા ડા | 6.16 | 7.92 | 11.9 | 6.6 | 3.96 | 2.29 | 17.6 |
| 21 | | Reference | | 2.46 | 7.05 | 3.35 | 11.9 | 6.16 | 3,96 | 51 51 | 17.6 |
| | | | | | | | | | | | TOBILO |

24.6 25.5 33.5 27.3 18.5 ALL 20.3 20.2 30.0 4-8kc 8-12kc 12-16kq16-20kg 2.9 6.15 2.73 \$ 16 6.2 ä 8 MALFUNCTION TEST DATA-ALARM TRANSMISSION TOP VIBRATION (Cont'd) 5.72 9.25 5.45 5.28 8.7 9.7 DATA RECORDED IN G'S (PK) 10.6 9.67 9.25 10.1 11.8 9.7 13.2 17.6 13.7 15.9 14.3 7.9 1-2kc | 2-4kc 4.23 13.2 17.6 15.8 7.93 6.0 10.6 3.88 4.58 6.16 5.28 4.0 .5-1ko 3.34 1.06 1.19 2.29 1.85 1.2 INDIC Reset Sens. Yes * *** * ** ¥ Main Rotor Unbalance (3w. W/Y) CONDITION(S) Reference Reference Reference Reference Reference Reference Reference Reference SECTION A (Cont'd) DATE CODE C) 2 O. a က က က -4 8/15 8/15 8/15 8/15 8/10 8/25 8/22 8/31 8/25

37

MALFUNCTION TEST DATA-ALARM TRANSMISSION TOP VIBRATION, (Cont'd)

| SECTION A (Cont'd) | (Cont'd) | | | | TRANS | TRANSMISSION TOP VIBRATION, (Cont'd) | TOP VI | TBRATIO | N,(Cont' | ਰ | |
|--|--|-----------|-------|--------|-------|--------------------------------------|--------|---------|-----------------|---------|--------|
| DATE CODE CONDITION(S) | CONDITIC | _ | INDIC | | DATA | 31 | D IN C | S (PK) | | | |
| | | <u>41</u> | NOTED | .5-1kc | 1-2kc | 2-4ko | 4-8kc | 8-12kc | 12-16kc 16-20kc | 16-20kg | ALL |
| Short Shaft Misalignment . 011" Shims Rem. Right 4 Rear Engine Mount | Short Shaft Misalignment .011" Shims Rem. Right Rear Engine Mount | | - | 1.2 | 3.9 | 15.0 | 14.0 | 12.2 | 8.8 | 5.7 | 28.0 |
| Short Shaft Misalignment . 023" Shims Rem. Right . Rear Engine Mount | Short Shaft Misalignment . 023" Shims Rem. Right Rear Engine Mount | | | | | | | | | | 28.0 |
| Short Shaft Misalignment . 023" Shims Rem. Right 4 Rear Engine Mount | Short Shaft Misalignment . 023" Shims Rem. Right Rear Engine Mount | | | 1.15 | 3.8 | 14.0 | 13.5 | 11.0 | 8.8 | 5.1 | 27.0 |
| Short Shaft Misslignment . 037" Shims Rem. Right 4 Rear Engine Mount | Short Shaft Misslignment .037" Shims Rem. Right Rear Engine Mount | | | 1.1 | 3.8 | 14.0 | 14.0 | 11.5 | 9.0 | 5.7 | 28.0 |
| V-Band Coupling (Engine) 4 Loss of Torque to 150"# | 80 2 | | | | | | | | | | 28.0 |
| V-Band Coupling (Engine) 4 Loss of Torque to 100"# | 20 22 | | | | | | | | | | 28.0 |
| V-Band Coupling (Engine) 4 Loss of Torque to 50"# | Couplin Torque | | | | | | | | | | 28.0 |
| 4 Reference | Reference | | | 1.15 | 3.9 | 14.0 | 15.0 | 12.0 | 8.8 | 5.6 | 28.0 |
| V-Band Coupling (Engine) 4 Loss of Torque to O"# | Coupling Torque t | | | | | | | | | | 31.0 |
| | | l | | | | | | | | | CPHIES |

MALFUNCTION TEST DATA-ALARM TRANSMISSION TOP VIBRATION (Cont'd)

SECTION A (Cont'd)

| | | | INDIC | | DATA 1 | RECORD | ED IN G | DATA RECORDED IN G'S (PK) | | | |
|-------|-----------|---------------------------------|-------|--------|--------|-------------|---------|---------------------------|-----------------|----------|------|
| CATE | PATE CODE | COMDITION(S) | NOTED | .5-1kc | 1-2kc | 2-4kc 4-8kc | 4-8kc | 8-12kc | 12-16k¢ 16-20k¢ | 16-20kc | ALL |
| 9/12 | 4 | Engine NII Turbine Unbalance | | | | | | | | | 27.0 |
| 9/14 | 4 | Engine NII Turbine Unbalance | | | | | | • | | | 28.0 |
| 10/12 | 4 | Reference | | 1.06 | 4.8 | 8.8 | 7.9 | 3.5 | 8.0 | 4.0 | 40.0 |
| 10/13 | 4 | Reference | | 1.15 | 4.2 | 17.4 | 16.7 | 13.0 | 8.8 | 5.3 | 32.0 |
| £1/01 | 4 | Reference | | 1.24 | 4.6 | ₹.71 | 17.4 | 14.0 | 9.6 | o. s | 31.5 |
| 10/16 | 4 | Reference | | 1.24 | . 9.4 | 17.4 | 17.4 | 13.0 | 9.6 | 5.7 | 34.0 |
| 91/01 | 4 | Reference | | 1.24 | 4.0 | 17.4 | 15.7 | 13.0 | 8.8 | ა. გ. | 31.5 |
| 10/16 | 4 | Reference | | 1.15 | 4.0 | 17.4 | 16.7 | 12.2 | 8.8 | 8. | 32.0 |
| 10/17 | 4 | Reference | | 1.15 | 4.4 | 17.4 | 15.7 | 12.2 | 8.8 | 4.6 | 30.0 |

MALFUNCTION TEST DATA-ALARM TRANSMISSION TOP VIBRATION (Cont'd)

| S | CTK | SECTION A (| (Cont'd) | | | TRANS | TRANSMISSION | TOP VI | BRATIO | TRANSMISSION TOP VIBRATION (Cont'd) | æ | |
|----------|-------|-------------|---|-------|--------|-------------|----------------------|---------|---------|-------------------------------------|---------|------|
| <u>_</u> | | | | INDIC | | DATA 1 | DATA RECORDED IN G'S | ED IN G | 'S (PK) | | | |
| 9 | DATE | CODE | CONDITION(S) | NOTED | .5-1ko | 1-2ko | 2-4kc | 4-8kc | 8-12kc | 12-16kc 16-20kc | 16-20ka | ALL |
| 07 | 10/18 | 4 | Reference | | 1.15 | 3.65 | 15.0 | 15.0 | 14.0 | 9.6 | 9.9 | 30.0 |
| 1 7 | 10/18 | 4 | Reference | | 1.5 | 4.6 | 14.0 | 15.7 | 12.2 | 8.8 | 5.7 | 28.0 |
| L | 10/18 | 4 | Short Shaft Misalignment . 060" Shims Rem. R. Rear Engine Mount | | 1.32 | 4.2 | 14.0 | 15.3 | 14.8 | 9.6 | 6.2 | 30.5 |
| | 61/01 | 4 | #1 XXMSN Oil Jet Clogged | | 1.15 | 4.2 | 12.2 | 15.0 | 11.3 | 7.5 | 5.3 | 25.3 |
| Ю Н | 10/20 | \$ | Annealed Gear and Bearing in XMSN Input Quill | | 1.2 | 3.65 | 13.0 | 13.5 | 13.5 | 11.3 | 9.6 | 31.5 |
| <u> </u> | 10/21 | \$ | Annealed Gear and Desring in YAKSM Input Quill | | 1.16 | 4. 8 | 15.7 | 17.4 | 14.8 | 11.3 | 7.9 | 36.5 |
| <u> </u> | 10/23 | 44 | Annealed Gear and Bearing in XMSN Input Quill | | 1.24 | 4.2 | 12.2 | 15.7 | 11.3 | 10.5 | 9.6 | 29.0 |
| <u> </u> | 10/24 | 44 | Annealed Gear and Bearing in XMSN Input Quill | | 1.15 | 4.3 | 14.0 | 15.0 | 14.0 | 11.3 | 7.0 | 29.0 |
| | 10/24 | 44 | Annealed Gear and Bearing in XMSN Input Quill | | 1.15 | 4.2 | 12.2 | 15.0 | 13.0 | 11.3 | 9.6 | 31.5 |

MALIFUNCTION TEST DATA-ALARM TRANSMISSION TOP VIBRATION (Cont'd)

SECTION A (Cont'd)

| | | | DADIC | | DATA I | DATA RECORDED IN G'8 (PK) | ED IN G | '8 (PK) | | | |
|-----------|------|------------------------------------|-------|---------|--------|---------------------------|-------------|---------|--------------------------|---------|-------------|
| DATE CODE | CODE | CONDITION(S) | NOTED | . 5-1ko | 1-2ko | 2-4ko | 4-8kc | | 12-16ko 16- 20k o | 16-20ko | ALL |
| 10/25 | 4.4 | Blocked Input Quill Oil Jet | | 1.15 | 4.2 | 13.0 | 14.0 | 12.2 | 8.8 | 5.3 | 26.0 |
| 10/26 | 44 | 14# Torque by Collective Pitch | | 1.4 | 4.6 | 21.0 | 7.71 | 14.8 | 9.6 | 5.4 | 36.5 |
| 10/26 | \$ | Normal Torque | | 1.16 | 4.2 | 18.3 | 15.7 | 14.0 | . 9.6 | 5.1 | 32.0 |
| 10/30 | 4.4 | All XMSN Oil Jets Blocked | | 1.16 | 4.0 | 17.4 | 15.0 | 13.0 | 8.3 | 4.8 | 2 .0 |
| 10/30 | 44 | N/C | | 1.15 | 4.0 | 17.4 | 15.0 | 12.2 | 8.6 | 6.8 | 31.6 |
| 10/30 | 44 | n/c | | 1.32 | 4.2 | 17.4 | 15.7 | 12.2 | 7.5 | 4. | 30.0 |
| 10/30 | * | #1 and #2 XMSN Oil Jeta Blocked | | 1.15 | 3.85 | 17.4 | 15.0 | 13.0 | 8.8 | 6.4 | 33.0 |
| 10/31 | 44 | #1 and #2 XMSN Oil Jets Blocked | | 1.06 | 4.0 | 17.4 | 15.0 | 11.3 | 8.8 | 4.7 | 30.5 |
| 10/31 | \$ | N/C | | 1.24 | 4.2 | 16.7 | 14.0 | 12.2 | 8.8 | 4.8 | 27.0 |

MALFUNCTION TEST DATA-ALARM TRANSMISSION TOP VIBRATION (Cont'd)

SECTION A (Cont'd)

| | | | INDIC | | DATA | DATA RECORDED IN G'S (PK) | ED IN G | 'S (PK) | | | |
|-------|-----------|---|-------|--------|-------|---------------------------|---------|---------|-----------------|---------|------|
| DATE | adoo aled | CONDITION(S) | NOTED | .5-1kc | 1-2kc | 2-4kc | 4-8kc | 8-12kc | 12-16kc 16-20kc | 16-20kc | ALL |
| | | | | | | | | | | | |
| 10/31 | 4A | #1, #2, #3 - Jets Blocked | | 1.32 | 4.2 | 17.4 | 16.7 | 14.0 | 8.8 | 5.1 | 30.5 |
| | | | | | | | | | | | |
| 11/1 | 44 4 | N/C | | 1.24 | 4.1 | 17.4 | 15.7 | 13.0 | 8.8 | 5.3 | 29.0 |
| | | | | | | | | | | | |
| 11/1 | 4.4 | N/C | | 1.24 | 4.2 | 17.4 | 14.0 | 13.0 | 8.8 | 5.3 | 31.5 |
| 11/1 | 4A | N/C | | 1.15 | 3.85 | 17.4 | 15.0 | 14.0 | 9.1 | 4.9 | 30.5 |
| 11/2 | 4B | .015" Flat on Lower Mast Bearing | | 1.32 | 3.6 | 17.4 | 15.0 | 13.0 | 8. 8. | 4.1 | 30.0 |
| 11/2 | 4B | .015" Flat + 15# Torque for 3 Min. Prior to Data | | 1.32 | 8.4 | 14.0 | 14.0 | 13.0 | & & | 4.9 | 29.0 |
| 11/3 | 4B | Extremely Low XMSN Oil Level | Yes | 1.93 | 5.7 | 24.5 | 28.0 | 28.0 | 16.5 | 15.0 | 57.0 |
| 11/3 | 4B | Extremely Low XMSN Oil Level | Yes | 2.0 | 7.5 | 20.0 | 20.0 | 21.0 | 14.0 | 17.4 | 42.0 |
| 11/3 | 4B | Above Just Prior to Bearing Failure | Yes | 2.63- | | | | | | | |

MALFUNCTION TEST DATA-ALARM TRANSMISSION TOP VIBRATION (Contid)

| | SECTION A | | (Cont'd) | | | TRANSM | MISSION | TOP VI | BRATIO | TRANSMISSION TOP VIBRATION (Cont'd) | J) | |
|---------------------------------------|-----------|-----------|--|-------|---------|--------|---------------------------|---------|-------------------------|-------------------------------------|---------|------|
| | | , | | INDIC | | DATA | DATA RECORDED IN G'S (PK) | ED IN G | 'S (PK) | | | |
| | DATE | DATE CODE | CONDITION(S) | NOTED | . 5-1kc | 1-2kc | 2-4kc | 4-8kc | 8-12kc | 8-12kc 12-16kc 16-20ka | 16-20kc | ALL |
| | 9/11 | 4C | Annealed Input Quill Replaced; Upper Planetary Gear Assembly Replaced | | 1.06 | 5.3 | 21.0 | 17.4 | 12.2 | 7.5 | 4.8 | 36.5 |
| | 11/6 | 4C | Reference | | 1.15 | 4.1 | 15.7 | 16.7 | 11.3 | 7.0 | 4.7 | 30.0 |
| | 11/6 | 4C | Reference | | 1.15 | 4.3 | 15.0 | 16.7 | 13.5 | 8.8 | 5.3 | 32.0 |
| 4 | 11/7 | 4°C | Reference | | 1.32 | 4.2 | 15.0 | 15.0 | 13.0 | 8.8 | 6.0 | 30.5 |
| 3 | 11/8 | 4C | Reference | | 1.2 | 4.1 | 15.7 | 15.7 | 12.2 | 8.3 | 8.8 | 30.5 |
| | | | CODE DESIGNATIONS: | | | • | | ACCEL | EROME' | ACCELEROMETER ORENTATION: | ENTATI | ON: |
| | | | 1. Flight Test Components (XMSN SN A12-20) | | | | | * * | - 45° Fro - Vertical | - 45° From Verical - Vertical | ical | |
| | | | 2. XMSN & Main Replaced (XMSN SN A12-142) | | | | | * | - Latera - Fore/ | I VFT | | |
| · · · · · · · · · · · · · · · · · · · | | | 3. Engine Replaced | | | | | | | | | |

MALFUNCTION TEST DATA-ALARM TRANSMISSION TOP VIBRATION (Cont'd) SECTION A (Cont'd)

| | | , | | ; ! | | | | | |
|-------------------------------------|------------------------|--------------------------------------|---|---|--|---|---|---|--|
| | ALL | | | | | | | ٠ | |
| | 16-20kd | | | | | | | | |
| I KANSMISSION TOP VIBRATION (CORTS) | 12-16kc | | | • | | | | | |
| OLI WAR | 8-12kc 12-16kc 16-20kd | | | | | | | | |
| | -2kc 2-4kc 4-8kc 8-1 | | | | | | | | |
| MUSSION TO STORY | 2-4kc | | | | | | | | |
| IRAND | 5-1kc 1-2kc | | | | | | • | | |
| | . 5-1kc | | | | | | | | |
| | INDIC | | | | | | | | |
| | CONDITION(S) | 4. XMSN Replaced (XMSN SN A12-78) | 4A. XMSN Input Quill Replaced (Annealed Gear & Bearing) | 4B015" Flat Introduced on Lower Mast Bearing (Inner Race) | 4C. Original Input Quill Re- installed; Upper Plane- tary Gear Ass'y Repl. | | | | |
| SECTION A (Control) | DATE CODE | | | | | | | | |
| SECT | DATE | | | | <u> </u> | 4 | | | |

SECTION B

MALFUNCTION TEST DATA-ALARM TRANSMISSION BASE VIBRATION (Cont.d)

| | | | | | TATA | INTERNATION DADE VIDENTION (CORUM | DATA PECOPDED IN C'S / DES | May 5 | 200 | 5 | |
|-------|------|--------------------------------------|-------|--------|--------|-----------------------------------|----------------------------|--------|----------------|---------|---------------|
| DATE | CODE | CONDITION(S) | INDIC | | 1 L | | | 2 | | | |
| 1 | | | NOTED | .5-1kc | 1-2kc | 2-4kc | 4-8kc | 8-12kc | 12-16kc16-20kc | 16-20kc | ALL |
| | | | | | | | , | , | • | 6 | (|
| 9/9 | -1 | Reference | | | 3.2 | 8.5 | 11.0 | 7.1 | 4.1 | 2.85 | 16.0 |
| | , | £ | | - | u F | 9 | <u> </u> | ď | o c | 6 | G G |
| م | _ | Kelerence | | | o. 13 | 0., | 6.01 | 0.0 | 9.0 | 9.0 | 0.61 |
| 6/9 | н | Reference | | | 3.15 | 8.2 | 12.0 | 7.5 | 4.2 | 2.85 | 17.0 |
| | | | | | | | | | | | 7 8 1 |
| 07 /0 | • | verer ence | | | | | | | | | |
| 6/28 | 1 | Reference | | | | | | | | | 15.8 |
| 67/9 | - | Reference | | _ | | | | | | | 15.4 |
| 1 | | Main Rotor Out of Track | | | | | | | | | |
| 67/5 | 1 | (1 Flat) | | | | | No Change | nge | | | |
| 6/28 | 1 | Main Rotor Out of Track (2 Flats) | | | | | | | | | 15.8 |
| 6/29 | 1 | Main Rotor Out of Track (3 Flats) | | | | | | | | | 15.8- 16.5 |
| 1 | | | | | | | | | | | |

MALFUNCTION TEST DATA-ALARM TRANSMISSION BASE VIBRATION (Cont'd)

| | ALL | | 15.4 | 15.4 | 15.0 | ; | 16.0 | , | | 15.0- 15.8 | 15.0- 15.8 | 17.2- 18.0 |
|----------------------|-----------------|----|------------------------------------|------------------------------------|-----------------------------------|---|-----------|---------------------------------|--------------------------------|---|---|---|
| | L | ┸. | 51 | 16 | <u> </u> | | 11 | i | | 16 | 11: | 37 |
| | 12-16kc 16-20ko | | | | | | | | | | | |
| 'S (PK) | 2 Kg | 1 | | | | | | эВи | 98 u | | | |
| DATA RECORDED IN G'S | 4-8kg | | | | | ٠ | | No Change | No Change | | | |
| RECORE | 2-4kg | | | | | | | | | | | |
| DATA | 1-2kc | | | | · | | | | . 1 | | | |
| | 5-1160 | | | | | | | | | | | |
| TATOLC | NOTED | | | | | | | | | | | Yes |
| | CONDITION(S) | | Main Rotor Unbalance (1w. W/Y) | Main Rotor Unbalance (3w. W/Y) | Main Rotor Unbelance (5w. W/Y) | | Reference | Damper Out of Time (12 Sec.) | Damper Out of Time (< 1 Sec.) | R. Rear Pylon Mount @ 1/2 Torque (480"#) | R. Front & Rear Pylon Mounts @ 1/2 Torque (480"#) | Short Shaft Misalignment: 15 Shims Removed (~035') L. Rear Eng. Mount |
| | CODE | | H | 1 | 1 | | 1. | H | 1 | 1 | 1 | |
| | DATE CODE | T | 67/9 | 6/29 | 6/29 | | 9/30 | 06/30 | 0€/9 | 0€/9 | 08/9 | 6/30 |

; ;

MALFUNCTION TEST DATA-ALARM TRANSMISSION BASE VIBRATION (Cont'd) SECTION B (Control)

| | | | INDIC | | DATA I | RECORDED IN | ED IN G | G'S (PK) | | | | |
|--------|-----------|--------------|-------|--------|--------|-------------|---------|----------|----------------|---------|----------------|--------|
| ATE | DATE CODE | CONDITION(S) | NOTED | .5-1kc | 1-2kc | 2-4kc | 4-8kc | 8-12kc | 12-16kc16-20kc | 16-20kc | ALL | |
| 08/9 | - | Roforence | | | | | | | | | 16.1- 16.5 | |
| 3 | • | 201012121 | | | | | | | | | | |
| 8/3 | - | Reference | · | : | | : | • | | | ., | 16.5- 17:2- | |
| 2/2 | - | Reference | | | | | | | | | 16.5 | · . |
| 7/11 | - | Reference | | | | | | | | | 16.5- 17.2 | |
| 7/18 | - | Reference | | 1.35 | 9. | 10.5 | 15.0 | .5 3. | 4.5 | * | 12.3 | |
| 7 / 2H | _ | Reference | | 1.12 | 3.38 | 9.0 | 11.2 | 6.75 | 4.5 | 4.0 | 16.7 | ; ; |
| 7/8 | ' H | Reference | | 0.975 | 2.85 | 6.74 | 10.5 | 5.24 | 3.15 | 2.1 | 15.0 | ; [|
| 0 / 0 | | Doforance | | 1 05 | 2.85 | 6.75 | 9. 75 | 5.4 | 3.38 | 2.25 | 15.0 | |
| 6/8 | 1 1 | Reference | | 0.975 | 3.0 | 8.62 | 10.5 | 5.62 | 3.60 | 2.62 | 15.7 | |

MALFUNCTION TEST DATA-ALARM TRANSMISSION BASE VIBRATION (Cont'd)

| | | ALL | 20.3 | 18.0 | 18.8 | 21.0 | 15.0 | 14.5 | 14.5 | 14.5 | 14.5 |
|---|-----------------|-----------------|------------------------------------|----------------|-----------|-----------|-----------|---|---|--|---|
| 'd) | | 16-20ko | 3.0 | | | 3.0 | 2.4 | 2.25 | | 2.4 | 2.4 |
| MALL UNCTION 1551 DATA TEARM. TRANSMISSION BASE VIBRATION (Cont'd) | | 12-16kc 16-20ko | 5.1 | | | 5.25 | 3.9 | 4.1 | | 4.2 | 4.4 |
| IBRATI | 'S (PK) | 8-12kc | 8.25 | | | 7.88 | 6.75 | 7.0 | | 6.8 | 6.6 |
| BASE | RECORDED IN G'S | 4-8kc | 12.0 | | | 13.5 | 8.6 | 9.5 | | ସ ଅ | 8.2 |
| MISSION | RECORD | 2-4kc | 9.0 | | | 9.0 | 6.7 | 7.1 | | 6.2 | 6.4 |
| TRANS | DATA | 1-2kc | 4.88 | | | 5.4 | 2.25 | 1.5 | | 2.9 | 2.5 |
| | | .5-1kc | 2.55 | | | 3.3 | 0.75 | 0.72 | | 06.0 | 0.83 |
| | INDIC | NOTED | Yes | Reset Sens. | | | | | | | |
| Cont'd) | | CONDITION(S) | Reference (Note Condition Code) | Reference | Reference | Reference | Reference | Short Shaft Misalignment; (.011") Shims Removed, R. Rear Engine Mount | Short Shaft Misalignment; (, 023") Shims Removed R. Rear Engine Mount | Short Shaft Misalignment; (. 023") Shims Removed, R. Rear Engine Mount | Short Shaft Misalignment; (.037") Shims Removed, R. Rear Engine Mount |
| SECTION B (Cont'd) | | DATE CODE | 2 | 2 | ~1 | 8 | 7# | ₩ 4 | 4 | 4, | 4 |
| SECT | | DAIE | 8/15 | 8/15 | 8, 15 | 8/22 | 8/31 | 8 /31 | 8/31 | : : : | 9/6 |

MALFUNCTION TEST DATA-ALARM TRANSMISSION BASE VIBRATION (Co

| SECTION | E | (Cont'd) | | | TRANS | MISSION | BASE V | 'IBRATI | TRANSMISSION BASE VIBRATION (Cont'd) | (p. | |
|---------|----------|---|-------|--------|-------|-----------------|---------|---------|--------------------------------------|---------|------|
| | | | INDIC | | DATA | RECORDED IN GIS | ED IN G | S (PK) | • | | |
| DATE | CODE | CONDITION(S) | NOTED | .5-1kc | 1-2kc | 2-4kc | 4-8kc | 8-12kc | 12-16kc 16-20ko | 16-20ko | ALL |
| 9/3 | च | V-Band Coupling (Engine) | | | | | | | | | 0 71 |
| | | | | | | | | | | | |
| 6/5 | ₩. | V-Band Coupling (Engine) Loss of Torque to 100"# | | | | | | | | | 14.0 |
| 9/2 | 4 | V-Band Coupling (Engine) Loss of Torque to 50"# | | | | | | | | | 14.0 |
| 9,76 | ব | Reference | · | 0.95 | 2.65 | 6.4 | 8.5 | 6.5 | 4.2 | 2.4 | 14.5 |
| £/6 | + | V-Band Coupling (Engine) Loss of Torque to 0"# | Yes | | | | | ; | | | 15.6 |
| 9/12 | 4 | NII Turbine Unbalance | | | | | | | | | 14.5 |
| 9/14 | 4 | NII Turbine Unbalance | | | | | | | | | 14.5 |
| 10/12 | 4 | Reference | | 0.68 | 2.85 | 0.98 | 2.25 | 0.68 | 0.345 | 0.225 | 18.0 |
| 10/13 | 4 | Reference | | 0.83 | 2.35 | 6.0 | 9.4 | 7.3 | 4.5 | 2.35 | 15.0 |

MALFUNCTION TEST DATA-ALARM TRANSMISSION BASE VIBRATION (Cont'd)

| SECTI | SECTION B (Cont'd) | Cont'd) | | | TRANS | TRANSMISSION | BASE V | TRANSMISSION BASE VIBRATION (C | ON (Cont'd) | t'd) | |
|--------|--------------------|---|-------|--------|--------|--------------|----------------------|--------------------------------|-----------------|---------|------|
| | | | INDIC | | DATA 1 | RECORD | DATA RECORDED IN G'S | 'S (PK) | - | | |
| DA LE | DATE CODE | CONDITION(S) | NOTED | .5-1kc | 1-2kc | 2-4kc | 4-8kc | 8-12kc | 12-16kc 16-20kc | 16-20kc | ALL |
| 10, 13 | -†1 | Reference | | 0.83 | 2.4 | 5.6 | 9.4 | 6.8 | 4.05 | 2.1 | 15.0 |
| 10/16 | 4 | Reference | | 0.90 | 2.65 | 7.1 | 12.3 | 7.1 | 9.8 | 2.1 | 15.0 |
| 10,′16 | ** | Reference | | 0.90 | 2.4 | 6.8 | 11.2 | 6.8 | 3.8 | 2.1 | 15.0 |
| 10/16 | y | Reference | | 0.83 | 2.55 | 6.8 | 9.8 | 6.4 | 4.1 | 2.85 | 15.0 |
| 10/17 | 4 | Reference | | 0.83 | 2.4 | 6.8 | 9.0 | 6.4 | 3.8 | 2.25 | 13.5 |
| 16, 18 | _4 | Reference | | 0.75 | 2.25 | 7.5 | 11.2 | 6.8 | 3.9 | 2.35 | 15.0 |
| 10/18 | 4 | Short Shaft Misalignment; .040" Shims Removed, R. Rear Engine Mount | | 06.0 | 2.85 | 7.1 | 11.2 | 7.1 | 4.1 | 2.2 | 15.8 |
| 10/18 | 4 | Short Shaft Misalignment: ,040" Shims Removed, R. Rear Engine Mount | | 0.83 | 2.4 | 6.8 | 9.8 | 6.4 | 3.6 | 2.03 | 15.0 |
| 10/18 | 4 | Reference | | 0.75 | 2.25 | 6.4 | 9.8 | 6.3 | 3.8 | 1.95 | 15.0 |
| | | | | | | | | | | | |

SECTION B (Cont'd)

MALFUNCTION TEST DATA-ALARM TRANSMISSION BASE VIBRATION (Cont'd)

| | _ | | | | | | | | | |
|---------------------------|-----------------|--|---|---|---|--|-------|-------------------------|--|--------------------|
| | ALL | 15.8 | 15.8 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 16.5 | 16.5 |
| | 16-20ka | 1.95 | 2.1 | 1.6 | 1.9 | 1.95 | 2.03 | 2.1 | 3.15 | 3.3 |
| | 12-16kc 16-20ko | 3.9 | 3.6 | 3.45 | 3.45 | 3.8 | 3.9 | 3.8 | 5.3 | 5.3 |
| 'S (PK) | | 6.4 | 6.6 | 6.3 | 6.4 | 6.4 | 6.8 | 6.8 | 7.5 | 7.5 |
| DATA RECORDED IN G'S (PK) | 4-8kc | 10.5 | 8.6 | 10.5 | 9.8 | 9.8 | 9.8 | 9.0 | 9.8 | 11.2 |
| RECORE | 2-4kc | 6.8 | 6.6 | 7.1 | 6.3 | 6.0 | 4.9 | 6.8 | 8.8 | 8.9 |
| DATA | 1-2kc | 2.35 | 2.1 | 2.25 | 2.5 | 2.2 | 2.4 | 2.7 | 2.2 | 2.35 |
| | .5-1kc | 0.72 | 0.75 | 0.68 | 0.72 | 0.64 | 0.83 | 0.90 | 0.90 | 0.83 |
| INDIC | NOTED | | | | | | | | Yes | Yes |
| | CONDITION(S) | Short Shaft Misalignment; . 060" Shims Removed, R. Rear Engine Mount | Short Shaft Misalignment; .060" Shims Removed, R. Rear Engine Mount | Short Shaft Misalignment; .080" Shims Removed, R. Rear Engine Mount | Short Shaft Misalignment; .100" Shims Removed, R. Rear Engine Mount | Short Shaft Misslignment; . 123" Shims Removed, R. Rear Engine Mount | | XMSN Oil Jet #1 Blocked | XMSN Input Quill Replaced; Annealed Gear and Bearing | Condition as Above |
| | DATE CODE | -11 | 44 | 4 | 4 | 44 | 4 | 41 | 4A | 4.4 |
| | DATE | 10/18 | 10/18 | 10/18 | 10/18 | 81/01 | 10/18 | 10/19 | 10/20 | 10/20 |

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| SECTION B | | (Cont'd) | | | MALFI | NCTIO | N TEST | MALFUNCTION TEST DATA-ALARM TRANSMISSION BASE VIBRATION (C | MALFUNCTION TEST DATA-ALARM TRANSMISSION BASE VIBRATION (Cont'd) | (0) | | |
|-----------|------------|--|-------|--------|-------|-------------|---------|---|---|------------------|------|---|
| | | | INDIC | | DATA | RECORDED IN | ED IN C | G'S (PK). | | | | |
| DATE | DATE CODE | CONDITION(S) | NOTED | .5-1kc | 1-2kc | 2-4kc | 1-8kc | 8-12kc | 12-16ko | 16-20kc | ALL | |
| 10/20 | 4.4 | Condition as Above | Yes | 1.05 | 2.5 | 7.1 | 9.8 | 0.8 | 5.4 | 3.4 | 17.2 | |
| 10/20 | 44 | Condition as Above | Yes | 0.83 | 2.25 | 6.8 | 10.9 | 7.5 | 5.4 | 3.15 | 17.2 | : |
| 10/21 | 44 | Condition as Above | Yes | 1.13 | 3.3 | 9.4 | 11.2 | 9.8 | 6.6 | 4.05 | 19.5 | |
| 10/23 | 44 | Condition as Above | Yes | 1.35 | 3.0 | 8.3 | 9.8 | 8.6 | 6.4 | 3.8 | 16.8 | |
| 10/24 | 44 | Condition as Above | Yes | 1.05 | 2.85 | 8.3 | 10.5 | 9.0 | 7.1 | 3.8 | 18.0 | 1 |
| 10/24 | 44 | Condition as Above | Yes | 0.98 | 2.55 | 8.3 | 11.2 | 9.0 | 6.4 | 3.8 | 18.0 | |
| 10/24 | 4 A | Condition as Above | Yes | 1.05 | 3.0 | 8.3 | 12.0 | 9.4 | 6.6 | 3.9 | 18.7 | |
| 10/25 | 4,4 | Input Quill Oil Jet Blocked | Yes | 0.98 | 2.55 | 7.1 | 10.0 | 8.3 | 5.5 | 3.15 | 16.5 | |
| 10/26 | 4A | #1, #2, Input Quill Jets and Line to Ring Jets Blocked | Yes | 1.2 | 2.7 | 7.5 | 10.5 | 8.6 | 5.6 | 3.0 | 18.0 | |

MALFUNCTION TEST DATA-ALARM TRANSMISSION BASE VIBRATION (Contd)

| SECT | ON B | SECTION B (Contid) | | | TRANS | MISSION | BASE | VIBRATI | TRANSMISSION BASE VIBRATION (Contd) | g | |
|-------|------------|----------------------------|-------|---------|--------------|-------------|-------|----------|-------------------------------------|----------|------|
| | | | INDIC | | DATA | RECORDED IN | | G'S (PK) | | | |
| DATE | DATE CODE | CONDITION(S) | NOTED | . 5-1kc | | 2-4kc | 4-8kc | 8-12kc | 12-16ka | 16-20kc | ALL |
| 6,0 | | Follogia syst inc motor in | 2 | 8 | • | 0 | | 9 | o u | <i>~</i> | ď |
| 10/30 | 4.A | All AMSN Oil Jets blocked | E S | 8 | #:· # | 9.0 | 6.04 | 2 | ; | 3 | |
| 10/30 | 4 A | N/C | Yes | 1.2 | 2. 89 | æ 8. | 10.9 | 9.0 | æ • | 8. 6. | 18.7 |
| 10/30 | 44 | N/C | ¥8 | 1.2 | 3.15 | 8. 8. | 11.2 | 8. | 7.5 | ø. 8 | 18.7 |
| 10/30 | \$ | #1 & #2 Oil Jets Blocked | Yes | 1.06 | 9.0 | 8.3 | 11.2 | 9.8 | 7.5 | 4.2 | 20.2 |
| 10/31 | \$ | #1 & #2 Oil Jets Blocked | Yes | 0.98 | 2.7 | 8.3 | 10.5 | 9.0 | 6.8 | 4.05 | 18.7 |
| 10/31 | \$ | N/C | Yes | 1.13 | 2.7 | 7.5 | 10.5 | 8.8 | 5.6 | 3.0 | 16.5 |
| 10/31 | 4. | #1, #2, #3 Jets Blocked | Yes | 1.06 | 2.85 | 8.3 | 11.2 | 9.4 | 6.4 | 3.6 | 18.7 |
| 11/11 | \$ | N/C | Yes | 1.13 | 3.15 | 8.3 | 12 | 9.0 | 6.4 | 3.6 | 18.7 |
| 11/1 | 4.4 | N/C | Yes | 1.05 | 2.7 | 8.0 | 10.5 | 9.8 | 6.4 | 3.8 | 18.7 |

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MALFUNCTION TEST DATA-ALARM TRANSMISSION BASE VIRRATION (Contid)

| SEC | LICH | SECTION B (Cont'd) | | | TRANS | MISSION | TRANSMISSION BASE VIBRATION (Cont'd) | 'IBRATI | ON (Con | (p.1 | |
|-------|-----------|--|-------|---------|-------|---------|--------------------------------------|---------|---------|-----------------|------|
| | | | INDIC | | DATA | RECORL | DATA RECORDED IN G'S (PK) | 'S (PK) | • | | |
| DATE | DATE CODE | CONDITION(S) | NOTED | . 5-1kc | 1-2kc | 2-4kc | 4-8kc | 8-12kc | 12-16kc | 12-16kc 16-20kc | ALL |
| 11/1 | 4.4 | N/C | Yes | 1.05 | 3.15 | 8.3 | 11.2 | 10 | 7.5 | 4.5 | 19.5 |
| | | .015" Flat on Lower | | | | | , | , | | | 3 |
| 11/2 | 4B | Mast Bearing | Yes | 1.05 | 3.0 | 8.6 | 13.5 | 11.6 | 8.0 | 4.05 | 21 |
| 11/2 | 4B | .015" Flat +15# Torque for 3 mins. Prior | Yes | 2.55 | 3.8 | 8.3 | 10.5 | 9.0 | 6.4 | 3.4 | 19.5 |
| 11/3 | 4B | Extremely Low XMSN Oil Level | Yes | 1.5 | 4.7 | 15.8 | 25.5 | 14.2 | 9.0 | 5.1 | 37.5 |
| 11/3 | 4B | Extremely Low XMSN Oll Level | Yes | 1.5 | 6.4 | 9.8 | 20.2 | 13.5 | 8.3 | 9.6 | 30 |
| 11/6 | 4C | XMSN Output Quill Disconnected | | 1.05 | 3.4 | 8.3 | 12 | 6.4 | 3.3 | 1.9 | 17.2 |
| 11,′6 | 4C | XMSN Output Quill Disconnected | | 0.90 | 2.5 | 5.9 | 9.6 | 5.6 | 2.8 | 1.7 | 14.2 |
| 11/6 | 4C | XMSN Output Quill Disconnected | | 0.83 | 2.4 | 5.3 | 9.0 | 5.3 | 3.0 | 1.7 | 14.2 |
| 11/6 | 4C | Reference Tail Rotor (Cutput Quill Connected) | | 0.83 | 2.65 | 7.1 | 10.5 | 6.4 | 3.6 | 2.25 | 15.8 |

SECTION B (Cont'd)

MALFUNCTION TEST DATA-ALARM TRANSMISSION BASE VIBRATION (Cont'd)

| | | | INDIC | | DATA | DATA RECORDED IN G'S (PK) | DED IN | 3'S (PK) | | | |
|------|-----------|--|-------|--------|-------|---------------------------|--------|----------|-----------------|---------|------|
| DAFE | DAFE CODE | CONDITION(S) | NOTED | .5-1kc | 1-2kc | 2-4kc | 4-8kc | 8-12kc | 12-16kq 16-20kc | 16-20ka | ALL |
| 2/11 | 4C | Reference | | 06.0 | 2.7 | 7.1 | 11.2 | 6.0 | 3.4 | 2.1 | |
| 11/8 | 4C | Reference | | 0.98 | 2.85 | 7.5 | 11.2 | 7.1 | 4.1 | 2.25 | 17.2 |
| | | CODE DESIGNATIONS | | | | | | | | | |
| | 1. | Flight Test Components (XMSN SN A12-20) | | | | | | | | | |
| · | 2. | XMSN & Main Mast Re- placed (XMSN SN A-12- 142) | | | | | | | | | |
| | 3. | Engine Replaced | | | | | | | | | |
| | 4. | XMSN Replaced (XMSN SN A12-78) | | | | | | | | | |
| | 4A. | XMSN Input Quili Replaced (Annealed Gear | | | | | | | | | |
| | 4B. | .015" Flat Introduced on Lower Mast Bearing (Inner Race) | | | | | | | | | |
| | | | | | | | | | | | |

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MALFUNCTION TEST DATA-ALARM

| _ | | | | | | <i>!</i> ' | | · | | |
|--------------------------------------|---------------------------|-----------------|--|---|---|------------|---|-----|------|---|
| | | ALL | | | · | | | | | , |
| ıt'd) | | 16-20kc | | ; | | | | | | |
| ION (Cor | | 12-16kc 16-20kc | 1 | | | | | | | |
| TRANSMISSION BASE VIBRATION (Cont'd) | DATA RECORDED IN G'S (PK) | 8-12kc | | | | | ; | · | | |
| N BASE | DED IN | 4-8kc | | | | | | | | |
| SMISSIO | RECOR | 2-4kc | , | | | | | | | |
| TRAN | DATA | 1-2kc | • | | | | | . • | | |
| | | .5-1kc | | | | | | | | |
| | INDIC | NOTED | | | | | | · | | |
| SECTION B (Cont'd) | | CONDITION(S) | Original Input Quill Re- Installed; Upper Planetary Gear Assembly Replaced | | | | | | | |
| TION B | (| adoolated | 4C. | | | | | | | |
| SEC | | DATE | | | , | | 6 | | | |

SECTION C

MALFUNCTION TEST DATA-ALARM AFT ENGINE VIBRATION

| | | | INDIC | D, | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | CORDED | AS VEC | TOR VE | SEOCITY | (IN/SE | 6 |
|------|---|---|-----------|-------|---|---|------------|---------|----------|--------|-----------------|
| CODE | Œ | CONDITION(S) | NOTED | 20-40 | | 40-80~ 80-160 160-320 320-500 500-1 kd 1-2 ko | 160-320 | 320-500 | 500-1 kc | 1-2 kc | ALL |
| н | | Reference | | | | | | | | | 0.59 ** |
| | | Reference | | | | | | | | | 0.56 ** |
| - | | Short Shaft Misalignment: 15 Shims Removed L. Rear Engine Mount. (≈.035") | | · | | | | | | | 0.68-** 0.73 |
| - | | Reference | | | | | | | | | 0.56-** 0.59 |
| | | Reference | | | | | | | | | 0.59-** 0.64 |
| - | | Reference | | | | | | | | | 0.64** |
| - | | Reference | | | | | | | | | 0.64 ** |
| | | Reference | | | | | | | | | 0.59-** 0.64 |
| - | | Tail Rotor Out of Track (4-1/2 Turns) | | | | | | | | | 0.59-** 0.68 |
| Į | O | * Pick-up Output Directly into Meter (No Circuit Load) | o Circuit | Load) | ** All | All Data: 10 | 10-500 CPS | S | | | CPINED |

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MALFUNCTION TEST DATA-ALARM AFT ENGINE VIBRATION (Cont'd)

| ECTI | ON C | Cont'd) | | | AFT | ENGINE | VIBRAT | | nt'd) | | |
|------|--|-----------------------------------|--|---|----------------|----------------|---------|---------|---------|-------|---|
| | | | INDIC | Ω | ATA RE | CORDEL | AS VEC | TOR VE | LOCITY | | G) |
| DATE | CODE | | ă | 20-40∼ | ~08-0₹ | | 160-320 | 320-500 | 500-1kc | 1-2kc | ALL |
| 11/2 | 1 | Reference | | | | | | | **** | 1 | 0.59-** 0.64 |
| 7/11 | 1 | Tail Rotor Unbalance (1 Wrap) | | | | | | | | | 0.64 ** |
| 11/1 | 1 | Tail Rotor Unbalance (2 Wraps) | Yes | | | | | | | | 0.78-** 0.83 |
| 7/24 | 1 | Reference * | | 0.123 | 0.147 | 0.27 | 0.343 | 998-0 | 0.416 | 0.515 | 0.93 |
| 7/25 | 1 | Reference * | | 0.147 | 0.128 | 0.27 | 0.343 | 0.343 | 0.343 | D. 44 | 0.88 |
| 1/8 | 1 | Reference | | 0.147 | 0.10 | 0.196 | 0.245 | 0.265 | 0.270 | 0.367 | 0.686 |
| 8/8 | 1 | Reference | | 0.10 | <.1 | 0.196 | 0.245 | 0.294 | 0.255 | 0.343 | 0.735 |
| 8/15 | 87 | Reference | | 0.10 | <.1 | 0.162 | 0.264 | 0.255 | 0.270 | 0.343 | 0.635 |
| 8/22 | 3(x) | Reference | | <,1 | <.1 | 0.113 | 0.196 | 0.176 | 0.152 | 0.206 | 0.4 |
| | DATE DATE DATE 1/11 1/11 1/25 1/25 1/25 1/25 1/25 1/2 | SECTION C (DATE CODE 7/11 | F CODE CONDITION(S) Tail Rotor Unbalance Tail Rotor Unbalance Tail Rotor Unbalance Reference Reference Reference Reference Reference Reference Reference Reference Reference | E CODE CONDITION(S) Reference 1 (1 Wrap) Tail Rotor Unbalance 1 (2 Wraps) 1 Reference 1 Reference 1 Reference 2 Reference 2 Reference 2 Reference 3(x) Reference | ION C (Cont'd) | ION C (Cont'd) | CODE | CODE | CODE | CODE | CODE CONDITION(S) INDIC DATA RECORDED AS VECTOR VELOCITY (IN/SE CODE CONDITION(S) NOTED 20-40. 10-160 1-300 320-500 500-180 1-2kc 1-2kc 1 (1 Wrap) |

* Pick-up Output Directly into Meter (No Circuit Load) ** All Data: 10-500 CPS

MALFUNCTION TEST DATA-ALARM AFT ENGINE VIBRATION (Cont'd)

SECTION C (Cont'd)

| CONDITION(S) | | | | | | | | | (|
|--|---|---|---|--|---|--|--|--|---|
| | NOTED | 20-40~ | 20-40~ 40-80~ 80-160 | 80-160 | 160-320 | 160-32d 320-50d 500-1kd | 500-1kd | 1-2kc | ALL |
| | | | | | | | | | |
| Reference | | 0.12 | 0.107 | 0.12 | 0.22 | 0.185 | 0.15 | 0.18 | 0.46 |
| Short Shaft Misalignment; (.011") Shims Removed, R. Rear Engine Mount | | 0.12 | 0.10 | 0.12 | 0.195 | 0.165 | 0.145 | 0.18 | 0.46 |
| Short Shaft Misalignment; (.023") Shims Removed R. Rear Engine Mount | | 0.10 | 0.09 | 0.12 | 0.21 | 0.17 | 0.145 | 0.17 | 0.46 |
| Short Shaft Mislaignment; (.023") Shims Removed, R. Rear Engine Mount | | 0.09 | 0.085 | 0.12 | 0.21 | 0.17 | 0.145 | 0.175 | 0.44 |
| Short Shaft Misalignment; (. 037") Shims Removed, R. Rear Engine Mount | | 0.10 | 0.08 | 0.11 | 0.195 | 0.18 | 0.145 | 0.18 | 0.44 |
| V-Band Coupling(Engine) Loss of Torque to 150"#. | | 0.145 | 0.10 | 0.12 | 0.195 | 0.16 | 0.14 | 0.17 | 0.44 |
| V-Band Coupling (Engine) Loss of Torque to 100"#. | | 0.12 | 0.10 | 0.12 | 0.205 | 0.17 | 0.145 | 0.17 | 0.46 |
| V-Band, Coupling (Engine) Loss of Torque to 50"# | | 0.12 | 0.09 | 0.11 | 0.195 | 0.185 | 0.145 | 0.16 | 0.44 |
| V-Band Coupling (Engine) Loss of Torque to 0"# | | | | | | | | | 0.46 |
| | Short Shaft Misalignment; 023") Shims Removed . Rear Engine Mount Short Shaft Mislaignment; 023") Shims Removed, . Rear Engine Mount . Rear Engine Mount . Rear Engine Mount -Band Coupling(Engine) oss of Torque to 150"#. -Band Coupling (Engine) oss of Torque to 50"# -Band, Coupling (Engine) oss of Torque to 50"# -Band Coupling (Engine) | lignment; moved fount aignment; moved, fount moved, fount Tount | Short Shaft Misalignment; 023") Shims Removed Rear Engine Mount Short Shaft Mislaignment; 022") Shims Removed, Rear Engine Mount Rear Engine Mount Band Coupling(Engine) 0ss of Torque to 150"#. Band Coupling (Engine) 0ss of Torque to 100"#. Band Coupling (Engine) 0ss of Torque to 100"#. Band Coupling (Engine) 0ss of Torque to 0"# Band Coupling (Engine) 0ss of Torque to 0"# Band Coupling (Engine) 0ss of Torque to 0"# | lignment; moved fount signment; moved, fount moved, fount fount fount fount 0.10 150"#. 0.12 150"#. 0.12 (Engine) 50"# 0.12 (Engine) 0.12 (Engine) 0.12 | lignment; moved fount signment; moved, fount moved, fount fount fount fount 0.10 0.08 0.08 0.08 0.10 0.10 0.10 0.10 | lignment; 0.10 0.09 0.12 0.21 signment; 0.09 0.085 0.12 0.21 moved, fount 0.09 0.085 0.12 0.21 fount 0.10 0.08 0.11 0.195 Eugine) 0.145 0.10 0.12 0.195 Engine) 0.12 0.10 0.12 0.205 (Engine) 0.12 0.09 0.11 0.195 (Engine) 0.12 0.09 0.11 0.195 (Engine) 0.12 0.09 0.11 0.195 | lignment; 0.10 0.09 0.12 0.21 signment; 0.09 0.085 0.12 0.21 moved, fount 0.09 0.085 0.12 0.21 femment; moved, fount 0.10 0.08 0.11 0.195 Eugine) 0.16 0.12 0.195 Engine) 0.12 0.10 0.12 0.195 (Engine) 0.12 0.09 0.11 0.195 | lignment; moved fount fo | ulgment; moved fount 0.10 0.08 0.12 0.21 0.17 0.145 0.17 algnment; moved, fount 0.09 0.085 0.12 0.21 0.17 0.145 0.175 gament; moved, fount 0.10 0.08 0.11 0.195 0.18 0.145 0.18 Engine) o.150"#. 0.145 0.10 0.12 0.195 0.16 0.14 0.17 (Engine) o.10"#. 0.12 0.10 0.12 0.195 0.145 0.145 0.17 (Engine) o."# 0.12 0.09 0.11 0.195 0.185 0.145 0.16 |

SECTION C (Cont'd)

MALFUNCTION TEST DATA-ALARM AFT ENGINE VIBRATION (Cont'd)

| | | . . | | | | _4_4 | | | · . | |
|---|-------------------------------|---|---|--|--|--|---------------------------------------|-----------|-----------|-----------------------------------|
| <u>()</u> | ALL | 0.46 | 0.49 | 9.6 | ō. 44 | . 4.46 | 4. 9. | 9.46 | 0.44- | 0.78 |
| (IN/SE | 1-2ke | 0.17 | | 0.160 | 0.16 | 0.17 | 0.165 | 0.185 | 0.11 | |
| LOCITY | 500-1ke | 0,16 | | 0.145 | 0.145 | 0.145 | 0.145 | 0.165 | 0.155 | |
| DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | 160-320 320-500 500-1ke 1-2ke | D.21 | | 0.196 | 0.185 | 0.195 | 0.15 | 0.205 | 0.205 | |
| AS VEC | 160-320 | 0.215 | | 0.22 | 0.18 | 0.22 | 6.17 | 0.22 | 0.22 | |
| CORDEL | | 0.10 | | 0.10 | 6. 11 | 0.107 | 0.09 | 0.098 | 0.106 | |
| ATA RE | 20-40~ 40-80~ 30-160 | 0.075 | | 0.085 | 0.085 | 80~0 | 0.08 | | 0,098 | |
| Ω | | 0.10 | | 0.105 | 0.09 | 0.10 | 0.09 | | 0.098 | |
| INDIC | NOTED | | | | | | | | | Yes |
| | CONDITION(S) | Reference ("Bishop's Hat" Installed) | "Bishop's Hat" Mounting Bolt © 0 Torque. | V-Band Coupling (Engine) Loss of Torque to 0"#, Free Turning | NII Turbine Unbalance (180º Orientation | NII Turbine Unbalance (90 ⁰ Orientation) | NII Turbine Rebalanced (Reference) | Reference | Reference | Tail Rotor Unbalance (2 Wraps) |
| | CODE | 4(x) | 4(x) | 4(x) | 4 | 4 | 4 | 4 | 4 | 4 |
| | DATE CODE | 9/0 | 9/6 | 2/6 | 9/12 | 9/14 | 9/18 | 10/12 | 10/12 | 10/12 |

MALFUNCTION TEST DATA-ALARM AFT ENGINE VIBRATION (Cont'd)

SECTION C (Cont'd)

| | | | | INDIC | ũ | ATA RE | CORDEL | AS VEC | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | LOCITY | (IN/SE | 3) |
|----|-------|-----------|---|-------|--------|----------------------|--------|---------|---|---------|--------|------|
| | DATE | DATE CODE | CONDITION(S) | NOTED | 20-40∼ | 20-40~ 40-80~ 80-160 | | 160-320 | 160-320 320-500 500-1kd | 500-1ko | 1-2kc | ALL |
| | 10/13 | 4 | Tail Rotor Unb <u>al</u> ance (1 Wrap) | | 0.215 | 0.11 | 0.11 | 0.245 | 0.22 | 0.175 | 0.17 | 0.64 |
| | 10/13 | 4 | Reference | | 0.106 | 960.0 | 0.125 | 0.225 | 0.205 | 0.14 | 0.185 | 0.54 |
| | 10/16 | 4 | Reference | | 0.12 | 0.117 | 0.106 | 0.235 | 0.27 | 0.17 | 0.17 | 0.56 |
| (| 10/16 | 4 | Misaligned 42 ⁰ Gear Box | | 0.12 | 960.0 | 960.0 | 0.22 | 0.22 | 0.17 | 0.17 | 0.54 |
| 61 | 10/16 | 4 | Reference | | - | | 960.0 | 0.22 | 0.22 | 0.155 | 0.165 | 0.49 |
| | 10/17 | 4 | Reference | | 0.106 | | 960.0 | 0.22 | 0.195 | 0.155 | 0.17 | 0.54 |
| | 10/18 | 4 | Reference | | 0.098 | 0.098 | 0.10 | 0.245 | 0.225 | 0.16 | 0.17 | 0.54 |
| | 10/18 | 4 | Short Shaft Misalignment; .040" Shims Removed, R. Rear Engine Mount | | 0.10 | 0.098 | 0.098 | 0.215 | 0.17 | 0.15 | 0.155 | 0.49 |
| | 10/18 | 4 | Reference (Shims Reinstalled) | | 0.098 | | 0.098 | 0.205 | 0.195 | 0.145 | 0.155 | 0.49 |

MALFUNCTION TEST DATA-ALARM AFT ENGINE VIBRATION (Cont'd)

SECTION C (Cont'd)

| nent; d, R. 0.098 0.098 0.22 0.195 0.136 0.155 0.4 d, R. 0.098 0.098 0.215 0.195 0.14 0.165 0.4 d, R. 0.098 0.098 0.235 0.205 0.14 0.165 0.4 0.098 0.098 0.24 0.205 0.14 0.165 0.4 0.098 0.098 0.24 0.205 0.15 0.155 0.16 0.098 0.098 0.24 0.205 0.15 0.16 0.4 0.098 0.098 0.24 0.205 0.15 0.16 0.4 0.098 0.106 0.205 0.15 0.155 0.155 0.6 0.098 0.106 0.205 0.20 0.15 0.15 0.15 0.6 0.098 0.106 0.205 0.27 0.155 0.155 0.6 0.098 0.106 0.205 0.27 0.155 0.15 0.6 0.098 0.117 0.22 0.125 0.155 0.16 0.6 | L | | | | INTIC | | ATA RE | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | AS VEC | CTOR VE | LOCITY | (IN/SE | <u></u> |
|--|----------|------|------|--|-------|--------|--------|---|---------|---------|---------|--------|---------|
| Short Shaft Misalignment; Short Shaft Misalignment; Coff of Short Shaft Misalignment; Coff of Shims Removed, R. Coff of Shims Removed, R. Coff of Shims Removed, R. Coff of O.196 Coff of O.215 Coff of O.196 Coff of O.215 Coff of O.196 Coff of O.215 Coff of O.215 Coff of O.225 Coff of O.22 | Δ | ATE | CODE | CONDITION(S) | NOTED | 20-40∿ | | | 160-320 | 320-500 | 500-1kc | L | ALL |
| Short Shaft Misalignment; Short Shaft Mount Shaft Mount Short Shaft Mount Short Shaft Mount Shaft Mount Short Shaft Mount Shaft Mount Short Shaft Mount Short Shaft Mount Shaft Mount Shaft Mount Shaft Mount Short Shaft Mount Short Shaft Mount Shaft Mount Short Shaft Mount Shaft Mount | 10 | /18 | 4 | Short Shaft Misalignment; .060" Shims Removed, R. Rear Engine Mount. | | | 0.098 | 0.098 | | 0.195 | | 0.155 | 0.54 |
| Short Shaff Misalignment; 123" Shims Removed, R. 10/15 4 Reference (Shims 10/15 1 1 10/15 1 1 1 1 1 1 1 1 1 | 10 | /18 | 4 | Short Shaft Misalignment; . 100" Shims Removed, R. Rear Engine Mount | | 960.0 | 0,106 | 0.098 | | 0.195 | | 0.165 | 0.54 |
| 10/13 4 Reference (Shims) 0.098 0.245 0.22 0.145 0.155 0.1 10/13 4 Reference (Annealed Spins) 0.098 0.024 0.205 0.15 0.16 0.4 10/24 4 Reference (Annealed Spins) 0.098 0.106 0.245 0.205 0.15 0.15 0.15 0.15 0.155 0.145 0.177 0.177 0.175 0.175 0.175 0.175 0.175 0.175 0.175 0.175 0.175 0.175 0.1 | 10 | //18 | 4 | Short Shaft Misalignment; 123" Shims Removed, R. Rar Engine Mount | | | | 0.098 | | 0.205 | | 0.165 | 0.54 |
| 10/13 4 Reference (Annealt-1 Taput 0.098 0.094 0.245 0.205 0.15 0.16 0.4 0.22 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 | | /13 | 4 | idS) | | 1 1 | 0.098 | | | 0.22 | | 0.155 | 0.54 |
| 4 Reference (Anneal of Toput 0.098 C.106 0.245 0.205 0.15 0.155 0.154 No. 245 0.205 0.15 0.155 0. | | //19 | 7 | Reference | | | 0.098 | 0.098 | 0.24 | 0.205 | | 0.16 | 0.54 |
| 4 Reference 0.106 0.205 0.37 0.155 0.117 0.22 0.22 0.145 0.177 < | 0. | 7/ | ₹# | તેઓerence (Annealહા Input દુવાથી - XMSN) | | | 0.098 | 0.106 | | 0.205 | 0.15 | 0.155 | 0.51 |
| 4 Reference 0.098 0.106 0.225 0.22 0.155 0.16 0.3 4 Reference 0.098 0.117 0.22 0.22 0.145 0.17 0.3 | 0. | /21 | ₩. | Reference | | | 0.106 | 0.106 | | 0.37 | | 0.155 | 0.51 |
| 4 Reference 0.098 0.117 0.22 0.22 0.145 0.17 0.0 | 10 | /23 | 4 | Reference | | | 0.098 | 0.106 | 0.225 | 0.22 | | 0.16 | 0.51 |
| | <u> </u> | /24 | 4 | Reference | | | 0.098 | 0.117 | 0.22 | 0.22 | - 1 | 0.17 | 0.54 |

MALFUNCTION TEST DATA-ALARM AFT ENGINE VIBRATION (Contd)

| S | ECTI | SECTION C | (Cont'd) | | | | AFT EN | GINE VI | AFT ENGINE VIBRATION (Contd) | N (Contd | 1 | i |
|----|-------|-----------|--|-------|--------|--------------|--------|---------|----------------------------------|----------|----------|------|
| | | 200 | | INDIC | Ω | ATA RE | CORDEL | AS VEC | DATA RECORDED AS VECTOR VELOCITY | LOCITY | (IN/SEC) | င) |
| | DATE | DATE CODE | CONDITION(S) | NOTED | 20-40∼ | 40-80~80-160 | | 160-320 | 160-320320-500500-1kc | 500-1kc | 1-2 kc | ALL |
| | 10/24 | 4 | Cycling, Audible Noise- Not Present | | | | 0.106 | 0.22 | 0.195 | 0.145 | 0.155 | 0.54 |
| | 10/24 | 4 | Cycling, Audible Noise- Present | Yes | | | 0.106 | 0.39 | 0.33 | 0.22 | 0.22 | 0.98 |
| | 10/24 | 4 | Reference * | | 0.098 | | | 0.195 | 0.195 | 0.145 | 0.17 | 0.51 |
| 6: | 10/25 | 4 | Reference | : | | 0.098 | 0.11 | 0.225 | 0.205 | 0.145 | 0.155 | 0.51 |
| | 10/25 | 4 | Tail Rotor Unbalance (2 Wraps) | Yes | 0.34 | 0.117 | 0.10 | 0.27 | 0.205 | 0.15 | 0.165 | 99.0 |
| | 10/25 | 4 | Tail Rotor Unbalance (1 Wrap) | Yes | 0.215 | 0.098 | 0.098 | 0.22 | 0.215 | 0.14 | 0.155 | 0.62 |
| | 10/25 | 4 | Tail Rotor Unbalance (1/2 Wrap) | | 0.145 | 0.098 | 0.117 | 0.235 | 0.205 | 0.145 | 0.165 | 0.56 |
| | 10/25 | 4 | Reference | | 0.098 | 0.098 | 0.098 | 0.215 | 0.195 | 0.145 | 0.155 | 0.49 |
| 1 | 10/26 | 4 | Reference (Unexplained Vib. Increase) | Yes | 0.145 | 0.098 | | 0.215 | 0.175 | 0.145 | 0.17 | 0.49 |

* Tail Rotor Torque Applied for Short Period During Run.

MALFUNCTION TEST DATA-ALARM

| U | SECTION C | | (Cont'd) | | | | AFT EN | GINE VI | AFT ENGINE VIBRATION (Cont'd) | N (Cont'o | 4 | | |
|-------------|-----------|---------|---|----------|----------------|----------------------------|--------|---------|---|-----------|--------|--------|----------------------|
| | | | | INDIC | Q | ATA RE | CORDEL | AS VEC | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | LOCITY | (IN/SE | (2) | |
| · | DATE | CODE | CONDITION(S) | NOTED | 20-40∿ | 40-80~80-160 | | 160-320 | 160-320 320-500 500-1kg | 500-1ko | 1-2 kg | ALL | |
| L | | | | | | | | | | | | er i g | 7 |
| لت | 10/30 | 4 | Reference * | | 0.11 | | 0.10 | 0.22 | 0.22 | 0.145 | 5.17 | 0.44 | 1 |
| | | | Short Shaft Unbalance | : | مؤتية والمستوا | e rigar e mality (f. 88 ma | | | | | į | | , |
| | 10/30 | 4 | (× 20 grams) | χος X | 0.12 | 0.080 | 0.165 | 0.235 | 0.245 | 0.155 | 0.165 | 29.0 | 1 |
| | 10/30 | 4 | Reference | | - | 8 | 0.117 | 0.22 | 0.195 | 0.15 | 16. | 0.51 | |
| | | <u></u> | Reference | | | | | | | T . | | | |
| 64 | 10/30 | 4 | (42° GB Failure) | | | 0.0 | 0.117 | 0.226 | 0.202 | 0.14 | 0.166 | 3 | |
| <u>'</u> -' | 10/30 | 4 | Reference | | | 0.098 | 0.11 | 0.22 | 0.205 | 0.146 | . 186 | 4.5 | ii i |
| <u> </u> | 10/31 | 4 | Reference | | | 0.117 | 0.106 | 0.215 | 0.185 | 0.136 | 0.17 | 0.51 | . 4/3) . L |
| <u> </u> | 10/31 | 4 | Reference (Low Oil Level - 90° GB) | | | | 0.10 | 0.22 | 0.195 | 0.136 | 0.16 | 0.51 | - |
| | 10/31 | * | Reference | | | | 0.11 | 0.22 | 0.195 | 0.145 | 0.165 | 0.51 | |
| | 1/11 | 4 | Reference | | 960.0 | 0.098 | 0.117 | 0.22 | 0.195 | 0.145 | D. 165 | 0.51 | |
| , * · | Tail | Rotor | * Tail Rotor Torque Applied for Short Period During Run | riod Dur | ing Run | | | | | | | | |

MALFUNCTION TEST DATA-ALARM AFT ENGINE VIBRATION (Cont'd)

| INDIC DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | D 20-40~ 40-80~ B0-160 | Yes 0.22 0.11 0.106 0.22 0.215 0.136 0.125 0.51 | Yes 0.22 0.106 0.106 0.22 0.21 0.136 0.145 0.54 | 0.145 0.098 0.125 0.245 0.205 0.136 0.15 0.54 | 0.13 0.098 0.117 0.235 0.22 0.136 0.155 0.54 | 0.12 0.106 0.11 0.225 0.18 0.136 0.15 0.51 | 0.11 0.098 0.117 0.245 0.195 0.136 0.155 0.54 | ., Yes 0.12 0.098 0.117 0.29 0.27 0.145 0.15 0.59 | Yes 0.098 0.098 0.117 0.27 0.215 0.14 0.16 0.56 | | 900 |
|---|------------------------|---|---|---|--|--|---|---|---|-------------------|----------------|
| | 0.106 | 0.106 | | 0.125 | 0.117 | 0.11 | 0.117 | 0.117 | 0.117 | 11 | 8 0.117 0.29 |
| | | | | | | | | | | · · · · · · | 0.098 0.098 |
| NOTED | Yes | | Yes | | | | | Yes | Yes | 200 | Yes |
| CONDITION(S) | | Tail Rotor Unbalance (1 Wrap) | Tail Rotor Unbalance (1/2 Wrap) | Tail Rotor Unbalance (1/2 Wrap) | Reference | Reference | Reference (Low Oil Level - 90º GB) | Reference (.015" Flat, Lower Mast Bearing) | Reference (.015" Flat, +15# Torque Prior) | Extremely Low Oil | Level - XMSN |
| | DATE CODE | 4 | | 4 | 4 | 4 | 4 | 4 | 4 | | 4 |
| 170 | 4 T C | 11/1 | 11/11 | 11/1 | 11/1 | 11/11 | 11/1 | 11/2 | 11/2 | ç | 11/3 |

MALFUNCTION TEST DATA-ALARM. AFT ENGINE VIBRATION (Cont'd)

| SECTION C | | (Cont'd) | | | | AFT EN | GINE VI | AFT ENGINE VIBRATION (Cont'd) | N (Cont' | ਓ | |
|-----------|------|---|-------|---------------------|--------|--------|---------|---|----------|--------|----------|
| | | | INDIC | Ω | ATA RE | CORDED | AS VE | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | LOCITY | (IN/SE | © |
| DATE | DATE | CONDITION(S) | NOTED | 20-40~40-80~ 80-160 | 40-80m | | 160-320 | 160-320 320-500 500-1kg 1-2 kg | 500-1kg | 1-2 kc | ALL |
| 11/4 | 4 | Short Shaft (XMSN Drive) Disconnected | | - | 4 | 0.12 | 0.32 | 0.12 | 0.117 | 0.145 | 0.37 |
| 11/4 | 4 | Short Shaft (XMSN Drive) Disconnected | | | | 0.155 | 0.27 | 0.12 | 0.12 | D. 145 | 0.37 |
| 11/4 | 4 | As Above + Audible Noise Present | | | | | | | | | 0.44 |
| 11/6 | 4 | XMSN Output Quill (T/R Drive) Disconnected; Short Shaft Connected | | | | 60.09 | 0.275 | 0.22 | 0.155 | 0.155 | 0.54 |
| 9/11 | 4 | As Above | | | | 60.0 | 0.27 | 0.22 | 0.145 | 0.155 | 0.54 |
| 11/6 | 4 | Reference | Yes** | 960.0 | 0.098 | 960.0 | 6.32 | 0.29 | 0.145 | 0.155 | 0.64 |
| 11/7 | 4 | Engine Mount Piliow Ass'ys | Yes | 0.145 | 0.098 | 0.10 | 0.32 | 0.29 | 0.17 | 0.155 | 0.62 |
| 11/7 | 4 | Reference | Yes | 0.125 | 0.098 | 0.098 | 0.30 | 0.27 | 0.16 | 0.155 | 0.64 |
| 11/8 | 4 | Reference (Re-Annealed 90° GB I/Q Gear) | Ves | 0.11 | 0.098 | 0.098 | 60 | 0.245 | 0.136 | 0.155 | 0.59 |

** Unexplained Nominal Increase Noted This Date

MALFUNCTION TEST DATA-ALARM
AFT ENGINE VIBRATION (Cont'd)

SECTION C (Cont'd)

| | INDIC | | DATA RECORI | ATA RECORI | CORI | ED | AS VEC | TOR VE | LOCITY | (IN/SE | C) | |
|---|---|----------|---------------|------------|------|--------|---------|------------------------|---------|--------------|---------------|-----|
| DATE CODE CONDITION(S) NOTED 20-40~ 40-80~ | CONDITION(S) NOTED 20-40~ | D 20-40~ | 20-40~ 40-80~ | 08-01 | | 80-160 | 160-320 | 160-320320-500 500-1kd | 500-1ka | 1-2kc | ALL | |
| Reference (Re-Annealed Yes 0.12 0.098 | ed Yes 0.12 | 0.12 | | 0.098 | | 0.10 | 0.29 | 0.26 | 0.16 | 0.155 | 0.64 | |
| 4 Reference Yes 0.136 0.098 | Yes 0.136 | 0.136 | | 0.098 | | 0.12 | 0.37 | 0.32 | 0.17 | 9.155 | 0:00 | |
| Cycling, Audible Noise- | dible Noise- | | | | | 0.17 | 0.22 | 0.22 | 0.155 | 0.17 | 0.49- 0.54 | . ; |
| Cycling, Audible A Noise-Present Yes | le Yes | | | | | 0.17 | 0.39 | 0.39 | 0.22 | 0.22 | 0.78- 0.83 | |
| Cycling, Audible A Noise-N/Present | Cycling, Audible Noise-N/Present | | | | | | | | 0.145 | 0.155 | 0.51 | |
| Cycling, Audible A Noise-Present Yes | le | Yes | | | | | | | | 0.22 | 9.78 | |
| CONDITION CODE DESIGNATION | CONDITION CODE DESIGNATION | | | | | · | | | | | | • |
| 1. Flight Test Components. (Eng. SN 00346) (XMSN SN A12-20) | 1. Flight Test Components. (Eng. SN 00346) (XMSN SN A12-20) | | | | | | | | | | | |
| 2. XMSN and Main Mast Replaced. (XMSN SN A12-142) | | | | | | | | | | | | |

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SECTION C (Cont'd)

MALFUNCTION TEST DATA-ALARM AFT ENGINE VIBRATION (Cont'd)

| | | | | | | | | |
|--|-------------------------------|--|---------------------------------------|---|-----|------|------|--|
| | ALL | | | | | | | |
| /IN/SE | 1-2kc | | | | · | | | |
| T OCTT | 500-1kd | | | | | | | |
| TOB VE | 320-500 | | | | | | | |
| DATA BECORDED AS WELLOCITY (IN/SEC) | 160-320 320-500 500-1kd 1-2kc | | | | | | | |
| תשתפטר | 30-160 | | | | | | | |
| ATA DE | 10-80v | | | | | | | |
| 6 | 20-40~ 40-80~ 80-160 | | | | | | | |
| | INDIC | | | | | | | |
| (compared to the compared to t | CONDITION(S) | 3. Engine Replaced (Eng. SN LE- 00112) | 4. XMSN Replaced. (XMSN SN A12-78) | (x) NII Turbine Power Shaft Thru Bolt @ 0 Torque. | | | | |
| | DATE CODE | | | | | | | |
| | DATI | | | | 0.0 | | | |

MALFUNCTION TEST DATA-ALARM

| SECTION D | ONO | | | | | FORW | ARD E | NGINE V | FORWARD ENGINE VIBRATION | N | | |
|-----------|-----------|--|----------|----------|--|----------|---------|---------|-------------------------------|--------|-------------------------|----------|
| 2 | | المستعدد | INDIC | D | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | CORDED | AS VEC | TOR VE | LOCITY | (IN/SE | (၁ | |
| DAIE | DATE CODE | CONDITION(S) | NOTED | | 20-40~40-80~ 80=160 | | 160-320 | 320-200 | 160-320 320-500 500-1kg 1-2kg | 1-2kc | ALL | |
| 6/28 | - | Reference | | | | | | _ | | | 1. 18 1. 18 1. 18 | : |
| | | | | | | | | | | | | |
| 6/30 | 1 | Reference | | | | | | | | | | _ |
| 6/30 | 1 | Short Shaft Misalignment; 15 Shims Removed (≈. 035") L. Rear Engine Mount. | | | | | | | | | 0.59-* 0.64 | |
| 08/9 | 1 | Reference | | | | | | | | | • | |
| 6/30 | 1 | Reference | | | | | | | | | 38 | 1. 16. |
| 7/3 | 1 | Reference | | | | | | | | | | |
| 7/5 | 1 | Reference | | | | | | | | | 0.64* | |
| 7/11 | 1 | Reference | | | | | | | | | | : 4 : |
| 7/11 | H | Tail Rotor Out of Track (4-1/2 Turns) | | | | | | | | | 0.49-* 0.59 | |
| All | All Data: | 10-500 CPS ** Original Pi | ickup Mo | unt (Wit | ginal Pickup Mount (With Cantilever Resonance) | ver Reso | nance) | | | | | |

MALFUNCTION TEST DATA-ALARM

| SE | CTIO |) Q N | SECTION D (Cont'd) | | | | FORWARD ENGINE VIBRATION (Cont'd) | D ENGI | NE VIBR | ATION (| Cont'd) | |
|------------|------|-----------|------------------------------------|-------|---------------------------|--------|---|---------|----------|-------------------------|---------|----------------|
| <u></u> | | | | INDIC | Q | ATA RE | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | AS VEC | TOR VE | LOCITY | (IN/SEC | 3 |
| a j | ATE | DATE CODE | CONDITION(S) | NOTED | NOTED 20-40~ 40-80~80-160 | 40-80∿ | | 160-320 | 320-500 | 160-320 320-500 500-1kd | 1-2kc | ALL |
| | | | | | | | | | <u>-</u> | | | |
| 2 | 7/11 | 1 | Reference | | | | | | | | | 0.56 |
| 12 | 7/11 | 1 | Tail Rotor Unbalance (1 Wrap) | | | : | | | | | | 0.54_* 0.59 |
| 1/2 | 7/11 | 1 | Tail Rotor Unbalance (2 Wraps) | Yes | | | | | | | | 0.59* |
| 7 | 7/18 | 1 | Reference | ** | 0.367 | 0.318 | 0.392 | 0.416 | 0.49 | 1.27 | 1.42 | 2.20 |
| | 7/24 | 1 | Reference | ** | 0.122 | 0.127 | 0.245 | 0.245 | 0.392 | 1.37 | 1.67 | 2.46 |
| 1/2 | 7/25 | 1 | Reference | | 0.108 | 0,118 | 0.177 | 0.343 | 0.49 | 0.49 | 0.44 | 0.98 |
| 1/ | 7/28 | 1 | Reference | | <.1 | 0.10 | 0.147 | 0.27 | 0.343 | 0.44 | 0.392 | 0.833 |
| 8/7 | ۲, | 1 | Reference | | 0.1 | <.1 | 0.137 | 0.245 | 0.318 | 0.392 | 0.416 | 0.857 |
| 8/8 | χo | 1 | Reference | | <.1 | <.1 | 0.127 | 0.235 | 0.294 | 0.392 | 4.0 | 0.833 |
| J . | | | | | | | | | | | | |

* All Data: 10-500 CPS

** Original Pickup Mount (With Cantillever Resonance)

MALFUNCTION TEST DATA-ALARM FORWARD ENGINE VIBRATION (Cont'd)

SECTION D (Cont'd)

| (SEC) | 1-2kc ALL | 0.835 | 30.0 | | 8 0.49 | | 8 0.46 | 0 | | 8 0.49 |
|---|-------------------------|-----------|------------------|-----------|---|---|---|---|--|---|
| ITY (IN | | D. 392 | 15 9. 388 | 0.32 | 3 0.32 | - | 0.32 | 2 0.32 | 0.3 | 2 0.32 |
| ELOC | 500- | 0.49 | 0.245 | 0.22 | 0.23 | 0.23 | 0.21 | 0.22 | 0.205 | 0.22 |
| CTOR V | 160-320 320-500 500-1kg | 0.294 | 0.167 | 0.16 | 0.155 | 0.16 | 0.145 | 0.16 | 0.13 | 0.16 |
| D AS VE | 160-320 | 0.216 | 0.118 | 0.11 | 0.10 | 0.11 | 0.11 | 0.11 | 0.10 | 0.11 |
| DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | 80-160 | 0.118 | <.1 | 90.06 | 0.06 | 90.06 | 0.063 | 0.06 | 0.053 | 0.053 |
| ATA RE | 20-40-40-80-80-160 | <.1 | <.1 | 0.06 | 0.07 | 0.065 | 0.067 | 0.05 | 0.058 | 0.062 |
| Ω | 20-40 | <.1 | <.1 | 90.0 | 0.1 | 0.05 | 0.057 | 90.0 | 60.0 | 0.062 |
| INDIC | NOTED | | | | | | | | | |
| | CONDITION(S) | Reference | Reference | Reference | Short Shaft Misalignment; .011" Shims Removed, R. Rear Engine Mount | Short Shaft Misalignment; .023" Shims Removed, R. Rear Engine Mount | Short Shaft Misalignment; .023" Shims Removed, R. Rear Engine Mount | Short Shaft Misslignment; .037" Shims Removed, R. Rear Engine Mount | V-Band Coupling (Engine) Loss of Torque to 150∵# | V-Band Coupling (Engine) Loss of Torque to 100"# |
| | DATE CODE | 2 | 3(x) | 4(x) | 4(x) | 4(x) | 4(x) | 4(x) | 4 (x) | 4(x) |
| | DATE | 8/15 | 8/22 | 8/31 | 8/31 | 8/31 | 9/5 | 9/2 | 9/5 | 9/5 |

ALL 0.46 0.4 0.49 3.0 0.46 0.49 0.46 56 0.46 6 DATA RECORDED AS VECTOR VELOCITY (IN/SEC) FORWARD ENGINE VIBRATION (Cont'd) 20-40~40-80~\$0-160 160-320 \$20-500 500-1kg 1-2kg 0.295 MALFUNCTION TEST DATA-ALARM. D. 32 0.32 0.32 0.33 0.31 0.32 0.225 0.245 0.195 0.195 0.220.220.23 0.135 0.157 0.205 0.175 0.135 0.13 0.12 0.1550.145 0.10 0.10 0.10 0.09 0.10 0.053 0.05 0.02 < .05 0.05 0.05 1 0.058 0.058 0.053 0.05 0.05 0.05 ---0.062 0.053 0.053 0.058 0.073 0.053 INDIC Yes Reference ("Bishop's Hat" Installed) V-Band Coupling (Engine); Loss of Torque to 0"# V-Band Coupling (Engine)
Loss of Torque to 50"# V-Band Coupling (Engine)
Loss of Torque to O"# "Bishop's Hat" Mounting Bolt @ O Torque Reference (NII Turbine in Balance) NII Turbine Unbalance (180º Orientation) NII Turbine Unbalance (90° Orientation) CONDITION(S) Free Turning Reference SECTION D (Cont'd) DATE CODE **X**(X) **X 4** X **4 X** X 4 4 4 4 10/12 9/12 9/18 9/14 9/2 9/2 9/6 9/6 2/6

SECTION D (Cont'd)

MALFUNCTION TEST DATA-ALARM FORWARD ENGINE VIBRATION (Cont'd)

| | | | INDIC | Q | ATA RE | CORDED | AS VEC | TOR VE | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | (IN/SE | 6 |
|-------|-----------|------------------------------------|-------|-------|----------------------|--------|---------|---------|---|--------|--------------|
| DATE | DATE CODE | CONDITION(S) | NOTED | | 20-40~40-80~ \$0-160 | | 160-320 | 320-500 | 160-320 320-500 500-1kd | 1-2kc | ALL |
| 10/12 | 4 | Reference | | | | | 0.136 | 0.175 | 0.205 | 0.235 | 0.49- |
| 10/12 | 4 | Tail Rotor Unbalance (2 Wraps) | | 0.39 | 0.117 | 0.10 | 0.22 | 0.44 | 0.44 | 0.44 | 0.64 |
| 10/13 | 4 | Tail Rotor Unbalance (1 Wrap) | | 960.0 | | - | 0.136 | 0.185 | 0.235 | 0.37 | 0.59 |
| 10/13 | 4 | Reference | | | | - | 0.125 | 0.17 | 0.235 | 0.37 | 0. 54 |
| 10/16 | | Reference | | 0.12 | | | 0.125 | 0.195 | 0.22 | 0.34 | 9.54 |
| 10/16 | 4 | Reference | | 0.098 | | | 0.12 | 0.22 | 0.195 | 0.29 | 0.39 |
| 10/16 | 4 | Reference | | | | | 0.12 | 0.165 | 0.22 | 0.34 | 0.54 |
| 10/17 | 4 | Reference | | 0.098 | | | 0.117 | 0.155 | 0.205 | 0.34 | 0.54 |
| 10/18 | 4 | Reference | | | | | 0.125 | 0.17 | 0.215 | 0.33 | 0.56 |

MALFUNCTION TEST DATA-ALARM FORWARD ENGINE VIBRATION (Cont'd)

SECTION D (Cont'd)

| _ | | | | 1 | | | | | | 78 |
|----------------------------------|------------------------|--|------------------------------------|--|--|--|---|------------------------------------|-----------|--|
| (3 | ALL | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 9.54 | 0.54 |
| (IN/SEC) | 1-2kc | 0.34 | 0.34 | 0.34 | 0.34 | 0.35 | 0.33 | 0.34 | 0.37 | 0.34 |
| LOCITY | 500-1ko | 0.195 | 0.22 | 0.235 | 0.205 | 0.235 | 0.235 | 0.215 | 0.215 | 0.205 |
| TOR VE | 20-200 | 0.136 | 0.145 | 0.15 | 0.165 | 0.175 | 0.165 | 0.165 | 0.155 | 0.16 |
| DATA RECORDED AS VECTOR VELOCITY | 160-320320-500 500-1ka | 0.117 | 0.12 | 0.12 | 0.22 | 0.12 | 0.117 | 0.13 | 0.12 | 0.136 |
| CORDED | | | | | | | | | | |
| ATA REC | 20-40~ 40-80~ B0-160 | | | | | | | | | |
| ď | 20-40∿ | | | | | | | | | |
| INDIC | NOTED | | | | | | | | | |
| | CONDITION(S) | Short Shaft Misalignment; .040" Shim Removal, R. Rear Engine Mount | Reference (Shims Re- Installed) | Short Shaft Misalignment; £60"Shim Removal, R. Rear Engine Mount | Short Shaft Misalignment; .080" Shim Removal, R. Rear Engine Mount | Short Shaft Misalignment; . 100" Shim Removal, R. Rear Engine Mount. | Short Shaft Missligmment; .123"Shim Removal, R. Rear Engine Mount | Reference (Shims Re- Installed) | Reference | Reference (Annealed XMSN Input Quill Installed) |
| | CODE | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | \$ |
| | DATE | 81/01 | 81/01 | 10/18 | 10/18 | 10/18 | 10/18 | 10/18 | 10/19 | 10/20 |

MALFUNCTION TEST DATA-ALARM FORWARD ENGINE VIBRATION (Cont'd)

SECTION D (Cont'd)

| | | | DICTIVI | à | ATA RE | CORDED | AS VEC | TOR VE | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | (IN/SE | 6 |
|-----------|------------|------------------------------------|---------|-------|----------------------|--------|---------|---------|---|--------|------|
| DATE CODE | CODE | CONDITION(S) | NOTED | | 20-40~ 40-80~ 80-160 | | 160-320 | 320-500 | 160-320 320-500 500-1kc | 1-2kc | ALL |
| 10/20 | 44 | Reference | | 0.106 | | | 0, 12 | 0.16 | 0.195 | 0.34 | 0.59 |
| 10/21 | 4 | Reference | | | | | | 0.265 | 0.205 | 9.34 | 25.0 |
| 10/23 | \$ | Reference | | | 1 | | | 0.17 | | 0.34 | 75.0 |
| 10/24 | \$ | Reference | | | | | 0.136 | 0.155 | 0.205 | 0.33 | 9.0 |
| 10/24 | . 4 | Reference | | | | | 0.12 | 0.155 | 0.205 | 0.34 | 0.54 |
| 10/25 | 44 | Reference | | | | | 0.125 | 0.15 | 0.195 | 9.34 | 35.0 |
| 10/25 | 44 | Tail Rotor Unbalance (2 Wraps) | | 0.145 | | 0.098 | 0.165 | 0.195 | 0.205 | 0.34 | 0.59 |
| 10/25 | 44 | Tail Rotor Unbalance (1 Wrap) | | 0.106 | | | 0.125 | 0.15 | 0.205 | 0.34 | 0.56 |
| 10/25 | 44 | Tail Rotor Unbalance (1/2 Wrap) | | | | | 0.125 | 0.15 | 0.205 | 0.34 | 0.54 |

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SECTION D (Cont'd)

MALFUNCTION TEST DATA-ALARM FORWARD ENGINE VIBRATION (Cont'd)

| | | () | | | | | | • | | (| | |
|-------|----------|---------------------------------------|-------|--------|----------------------|--------|---------|---------|-------------------------|----------|------|------------|
| 7 | 3000 | | INDIC | Ď | DATA RECORDED | CORDED | AS VEC | TOR VE | AS VECTOR VELOCITY | (IN/SEC) | C) | |
| 21 12 | CODE | CONDITION(S) | NOTED | 20-40~ | 20-40~ 40-80~ B0-160 | | 160-320 | 320-500 | 160-320 320-500 500-1kd | 1-2kc | ALL | |
| • | | | | | | | | | | | | _ |
| 10/25 | 44 4 | Reference | | 0.106 | | | 0.12 | 0.165 | 0.205 | 0.32 | 0.56 | · - |
| | | | | | | | | | | | | |
| 10/30 | 4₽ | Reference | | 0.098 | 0.098 | 0.098 | 0.12 | 0.17 | 0.215 | 0.34 | 0.49 | - |
| 10/30 | 44 | Short Shaft Unbelance (≈ 20 Grams) | | | 0.125 | 0.195 | 0.136 | 0.17 | 0.22 | 0.37 | 99.0 | |
| 10/30 | 4.4 | Reference | | 0.098 | 0.098 | 0.098 | 0.12 | 0.15 | 0.22 | 78.0 | 0.62 | |
| 6 | ļ | , | | | | | | | ľ | | | |
| 10/30 | \$ | Kelerence | | | 0.098 | 0.098 | 0.117 | 0.15 | 0.235 | 0.34 | 0.62 | <u> </u> |
| 10/30 | 4 | Reference | | i | 0.098 | 0.098 | 0.11 | 0.155 | 0.225 | 0.34 | 0.59 | |
| 10/31 | 44 | Reference | | | 0.10 | 0.10 | 0.117 | 0.145 | 0.215 | 0.39 | 0.64 | , |
| 10/31 | 4A | Reference | | | 960.0 | 0.098 | 0.117 | 0.145 | 0.205 | 0.32 | 0.59 | |
| 10/31 | 4A | Reference | | | 0.098 | 0.098 | 0.117 | 0.145 | 0.215 | 0.32 | 0.56 | |
| | | | | | | | | | | | | |

MALFUNCTION TEST DATA-ALARM FORWARD ENGINE VIBRATION (Cont'd)

| S | SECTION D | ON D | (Cont'd) | | | | FORWA | RD ENG | MALL CHOLLION 1531 DAIN ALARM. FORWARD ENGINE VIBRATION (Cont'd) | RATION | (Cont'd) | |
|----------|-----------|------------|---|-------|-------|----------------------|---------------|---------|---|---------|--------------|------|
| | | | | INDIC | Ω | ATA RE | DATA RECORDED | AS VEC | AS VECTOR VELOCITY | LOCITY | (IN/SEC) | C) |
| 7 | ATE | DATE CODE | CONDITION(S) | NOTED | 20-40 | 20-40~ 40-80~ B0-160 | | 160-320 | 160-320320-500 500-1kg | 500-1ko | 1-2kc | ALL |
| | 1/11 | 44 | Reference | | | 0.098 | 0.10 | 0.12 | 0.165 | 0.22 | 0.32 | 0.59 |
| <u> </u> | 1/11 | 4\$ | Tail Rotor Unbalance (1 Wrap) | | 0.106 | 0.11 | 0.10 | 0.16 | 0.185 | 0.195 | 0.22 | 0.59 |
| | 11/1 | 4 A | Tail Rotor Unbalance (1/2 Wrap) | | 0.106 | 0.106 | 0.10 | 0.125 | 0.16 | 0.22 |) .32 | 0.59 |
| 7 | 11/1 | 44 | Reference | | 0.098 | 0.106 | 0.098 | 0.125 | 0.165 | 0.235 | 5.32 | 0.59 |
| | 17/1 | \$ | Reference | | - | 0.10 | 0.10 | 0.106 | 0.145 | 0.215 | ₹ 6.0 | 0.56 |
| . | 11/2 | 4B | Reference (.015" Flat, Lower Mast Bearing) | | 0.098 | 0.098 | 0.098 | 0.11 | 0.12 | 0.205 | 0.32 | 0.54 |
| <u>;</u> | 11/3 | 4B | Reference (Loss of Oil, XMSN) | | | 0.098 | 0.10 | 0.12 | 0.136 | 0.205 | 0.29 | 0.54 |
| ਜ | 11/4 | 4B | Short Shaft (XMSN Drive) Disconnected | | 1 1 | | | 0.22 | 0.12 | 0.17 | 0.225 | 0.39 |
| 7 | 11/4 | 4B | Short Shaft (XMSN Drive) Disconnected | | | ! | - | 0.098 | 0.098 | 0.155 | 0.22 | 0.34 |

• • •

MALFUNCTION TEST DATA-ALARM FORWARD ENGINE VIBRATION (Cont'd)

| | OECITON D | (Cont'd) | | | | FORWAI | ENG. | FORWARD ENGINE VIBRATION (Cont'd) | RATION | (Cont'd) | |
|-----------|-----------|--|-------|---------------------|--------|--------|---------|---|---------|----------|------------|
| 00 000 | - | | INDIC | Ω | ATA RE | CORDED | AS VEC | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | LOCITY | (IN/SE | () |
| DATE CODE | 300 | CONDITION(S) | NOTED | 20-40~40-80~ 80-160 | 10-80∼ | 80-160 | 160-320 | 160-320 320-500 500-1kg | 500-1ko | 1-2kc | ALL |
| 11/6 4C | - | XMSN Output Quill (T/R Drive) Disconnected. | | | | 0.09 | 0.106 | 0.117 | 0.205 | 0.29 | 0.49 |
| 11/6 4C | | XMSN Output Quill (T/R Dirve) Disconnected. | | | • | 0.09 | 0.098 | 0.11 | 0.195 | 0.29 | 0.46 |
| 11/6 4C | | Reference | | | 0.098 | 0.10 | 0.125 | 0.145 | 0.18 | 0.29 | 0.54 |
| 11/7 4C | | Engine Mount Pillow Ass'ys © O Torque | | 0.098 | 0.098 | 0.098 | 0.13 | 0.145 | 0.205 | 0.29 | 0.54 |
| 11/7 4C | | Reference (Eng. Mounts Re-Torqued) | , | 0.098 | 0.098 | 0.098 | 0.145 | 0.16 | 0.205 | 0.32 | 0.54 |
| 11/8 4C | | Reference | | | 0.098 | 0.098 | 0.136 | 0.12 | 0.205 | 0.32 | 0.84 |
| 11/9 4C | | Reference | | | 0.098 | 0.098 | 0.155 | 0.17 | 0.205 | 0.29 | 0.54 |
| | | CONDITION CODE | | | | | | | | | |
| | | Flight Test Components: (Eng. SN-00346) (XMSN SN-A12-20) | | | | | | | | | |

SECTION D (Cont'd)

MALFUNCTION TEST DATA-ALARM FORWARD ENGINE VIBRATION (Cont'd)

| | | | INDIC | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | |
|-----------|------|---|-------|--|----|
| DATE CODE | CODE | CONDITION(S) | NOTED | 20-40~ 40-80~ 80-160 160-320 320-500 500-1kg 1-2kc ALL | اد |
| | | 2. XMSN and Main Mast Replaced: (XMSN SN- A12-142) | | | |
| | | 3. Engine Replaced: (Eng. SN LE- 00112) | | | |
| | | 4. XMSN Replaced: (XMSN SN A12-78) | | | |
| | | (x) NII Turbine Power Shaft Thru Bolt @ O Torque | | | • |
| 79 | | 4A. XMSN Input Quill Replaced (Annealed Gear & Bearing) | | | |
| | | 4B015" Flat Introduced on Lower Mast Bearing (Inner Race) | | | |
| | | 4C. Original Input Quill Installed; Upper Planetary Gear Assy Replaced. | | | |
| | | | | | , |
| | | | | | |

| NO | (၁) | ALL | 1.45- 1.6 · | 1.45 | 1.36 | 1.36 | 1.37- | 1.36- | 1.36- | 1. 42- 1. 51 | 1.57- 1.6 |
|--|---|--|----------------|-----------|--|--|---|---------------------------------------|--|--|--|
| BRATI | (IN/SE | 1-2KC | | | <u> </u> | | PS S | | | | / |
| MALFUNCTION TEST DATA-ALARM TAIL VIBRATION | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | 20-40~ 40-80~ 80-160 160-320 320-500 500-1KC 1-2KC | | | | | "ALL" Reading 10-500 CPS | | | | |
| ALAR | CTOR V | 320-50 | | | | | Reading | : | | | |
| DATA- | AS VE | 160-320 | | | | | "ALL" | | | | |
| N TEST | CORDED | 80-160 | | | | | | | | | |
| UNCTIC | ATA REC | 40-80~ | | | | | | | | | |
| MALE | D' | 20-40∼ | | | | | | | | | |
| | INDIC | ል | | | | | | | | | Yes |
| | SPIROLEIGIA OO | CONDITION(S) | Reference * | Reference | 5 Shaft-Bearing Coupling Clamps in Line | 9 Shaft-Bearing Coupling Clamps in Line | Tail Rotor Out of Track (1/2 Turn-PCL) | Tail Rotor Out of Track (2 Turns-PCL) | Tail Rotor Out of Track (3 Turns-PCL) | Tail Rotor Out of Track (6 Turns-PCL) | Tail Rotor Out of Track (7-1/2 Turns-PCL) |
| SECTION E | 3C () | DATE CODE | H | 1 | 1 | - | 1 | 1 | 1 | 1 | 1 |
| SEC' | F & C | DA1E | 6/28 | 08/9 | 7/3 | 7/3 | 7/3 | 7/3 | 7/3 | 7/3 | 7/3 |
| | | | | | | 8 | 0 | | | | |

| | | | | | | FT | Lateral Fore/A | | * * | |
|---------------------------------------|----------------|---|--|---|--|---|---|--|---|--|
| | | | | | | | | /ibration Pick-Up)rientation | | |
| | | | | | | | | (ail Rotor Unbalance (1 Wrap) | | 7/11 |
| | | | | | | | | Reference *** | 7 | 7/11 |
| | | | | ., | | | Yes | (2 Wraps) | н | 7/11 |
| | | | | | | | Yes | fail Rotor Unbalance (1 Wrap) | н | 7/11 |
| , , , , , , , , , , , , , , , , , , , | J 005-0 | oo diina | 4 1 1 1 1 1 W | | | | | Reference ** | , | 7/11 |
| | | | | | | | | Reference | 1 | 7/5 |
| | | | | | | | Yes | Fail Rotor Unbalance (2 Wrap 2" Tape) | П | 7/5 |
| | | | | | | | | fail Rotor Unbalance (1 Wrap 2" Tape) | 1 | 7/5 |
| 1-2KC | 500-1 KC | 320-500 | 160-320 | 80-160 | 40-80 | 20-40 | NOTED | CONDITION(S) | CODE | DATE |
| RATIOI V (IN/S | AIL VIB | ARM T | ATA-AL | TEST D | NCTION ATA BE | MALFU | | (Cont 'd.) | TION E | SEC |
| | RATIO T-2KC | SILOCITY (IN/S) S00-1KC 1-2KC 0-500 CPS | ARM TAIL VIBRATIO CTOR VELOCITY (IN/S 320-500 500-1KC 1-2KC Bading 10-500 CPS | ATA-AL ARM TAIL VIBRATIO AS VECTOR VELOCITY (IN/S) 160-320320-500500-1KC 1-2KC ALL" Reading 10-500 CPS | CORDED AS VECTOR VELOCITY (IN/SI 80-160 160-320320-500 500-1KC 1-2KC "ALL" Reading 10-500 CPS | ATA RECORDED AS VECTOR VELCOCITY (IN/S) 40-80 80-160 160-320320-500 500-1KC1-2KC "ALL" Reading 10-500 CPS "ALL" Reading 10-500 CPS | MALFUNCTION TEST D DATA RECORDEI 20-40 40-80 80-160 | i a l | CONDITION(S) INDIC CONDITION(S) NOTED ALL Wrap 2" Tape) Tail Rotor Unbalance (2 Wrap 2" Tape) Teference (2 Wrap 2" Tape) Teference (3 Wrap 2" Tape) Teference (4 Wrap) Teference (5 Wraps) Teference (6 Wraps) Teference (7 Wraps) Teference (8 Wraps) Teference (9 Wraps) Teference (1 Wrap) Teference (2 Wraps) Teference (3 Wraps) Teference (4 Wrap) Teference (5 Wraps) Teference (6 Wraps) Teference (7 Wraps) Teference (8 Wraps) Teference (1 Wrap) Teference (2 Wraps) Teference (3 Wraps) Teference (4 Wraps) Teference (5 Wraps) Teference (6 Wraps) Teference (7 Wraps) Teference (8 Wraps) Teference (9 Wraps) Teference (1 Wraps) Teference (1 Wraps) Teference (2 Wraps) Teference (3 Wraps) Teference (4 Wraps) Teference (5 Wraps) Teference (6 Wraps) Teference (7 Wraps) Teference (8 Wraps) Teference (9 Wraps) Teference (1 Wraps) Teference (1 Wraps) Teference (2 Wraps) Teference (3 Wraps) Teference (4 Wraps) Teference (5 Wraps) Teference (6 Wraps) Teference (7 Wraps) Teference (8 Wraps) Teference (9 Wraps) Teference (1 Wraps) Teference (1 Wraps) | TON E (Cont'd.) CODE CONDITION(S) INDIC NOTED 1 (1 Wrap 2" Tape) 1 Tail Rotor Unbalance |

| Cont 'd. | 3 | ALL | 6.8- 7.2 | 2.45 | 2.53 | 3.50 | 1.12- 1.18 | 1.12- 1.18 | 4.4- 4.05 | 4. 4- 4. 05 | 2. 45 |
|--|---|-----------------------------|-----------------------------------|---------------|----------------------------------|-----------------------------------|--------------------------|-------------------------|---------------|---------------------------------------|----------------|
| ATION (| (IN/SEC | 1-2KC | | | | | · > s | | | | |
| IL VIBR | LOCITY | 500-1Kd | | | | | -500 CF | | | | |
| ARM TA | TOR VE | 160-320320-500500-1KG 1-2KC | | | | | "ALL" Reading 10-500 CPS | | | | |
| ATA-AL | AS VEC | 160-320 | | | | | ALL" R | | | | |
| MALFUNCTION TEST DATA-ALARM TAIL VIBRATION (Cont'd | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | | | | | | | | | | |
| NCTION | ATA RE | 20-40~ 40-80~ 80-160 | | | | | | | | | |
| MALFU | Ď | 20-40∼ | | | | | | | | | |
| | INDIC | NOTED | Yes | | | Yes | | | | | |
| SECTION E (Cont'd.) | | CONDITION(S) | Tail Rotor Unbalance (2 Wraps) | Reference *** | Tail Rotor Unbalance (1 Wrap) | Tail Rotor Unbalance (2 Wraps) | Reference ** | Tail Rotor Out of Track | Reforence *** | Tail Rotor Out of Track (4-1/2 Turns) | Ruference **** |
| TION E | | DATE CODE | 1 | 1 | H | 1 | 1 | | | | F. |
| SEC | | DATE | 7/11 | 7/11 | 7/11 | 7/11 | 7/11 | 7/11 | 7/11 | 7/11 | 7/11 |

| П | | | | | | | | | | |
|---|---|---|-----------|------------------------------------|-----------------------------------|--------------------------------|-------------------------------------|---------------|-----------|-----------|
| 1 | ALL | 2.45 | 2.6 | 6.4 | 1. 22 | 1.27 | 1.22 | 6.37 | 5.4 | 6.35 |
| (IN/SE | 1-2KC | 8 | | 0.294 | 0.1 | 0.1 | 0.142 | 0.1 | 0.1 | 0.1 |
| LOCITY | 500-1KC | 500 | | 0.343 | 0.132 | 0.142 | 0.167 | 0. 22 | 0.176 | 0.157 |
| DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | 20-40~ 40-80~ 80-160 160-320320-500500-1KQ1-2KC | 20 003-01 mask-and 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | | 0.59 | 0.38 | 0.344 | 0.245 | 0.68 | 0.54 | 0.54 |
| AS VEC | 160-320 | | | 2.2 | 0.685 | 0.636 | 0.49 | 2. 45 | 2.16 | 2.85 |
| CORDED | 80-160 | | | 5.9 | 0. 49 | 0.49 | 0.59 | 5.4 | 5.15 | 5.4 |
| ATA RE | 40-80∿ | | | 1.96 | 0.59 | 0.54 | 0.59 | 2.06 | 2.06 | 1.96 |
| Ď | 20-40∿ | | | 0.44 | 0.186 | 0.27 | 0.197 | 0.294 | 0.294 | 0.294 |
| INDIC | \Box | | | ! | | | | | | |
| | CONDITION(S) | Tail Rotor Out of Track (4-1/2 Turns) | Reference | Reference (No Circuit Load) *** | Reference (No Circuit Load) ** | Reference (No Circuit Load) | Reference (No Circuit Load) **** | Reference *** | Reference | Reference |
| 200 | CODE | 1 | H | 1 | 1 | 1 | 1 | 1 | 1 | П |
| 1 | DATE | 7/11 | 7/13 | 7.18 | 7/24 | 7/25 | 7/25 | 7/25 | 7/28 | 7/8 |

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| | SECT | SECTION E | (Cont'd.) | | MALFUN | DATA RECORDED | TEST DA | AS VEC | TOR VE | MALFUNCTION TEST DA PA-ALARM TAIL VIBRATION (Cont'd. DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | N (Cont 'd.) |
|----|------|-----------|-----------------------------------|---------|---------------|---------------|---------|--------|---------|--|---------------|
| ã | ATE | DATE CODE | CONDITION(S) | D | 20-40v 40-80v | | 80-160 | | 320-500 | 80-160 160-320320-500500-1Kd1-2KC | ALL |
| L | | | | | | | | , | | | |
| L | 8/8 | - | Reference | | 0.270 | 1.96 | 5.4 | 2.2 | 0.49 | 0.172 | 6.30 |
| æ | 8/15 | 2 | Reference | | 0. 206 | 1.32 | 3.18 | 1.52 | 0.392 | 0.147 | 3.92 |
| 80 | 8/15 | 8 | Tail Rotor Unbalance (2 Wraps) | Yes | 0.637 | 3.18 | 4.41 | 1.86 | 0. 49 | 0.137 | 6.38 |
| | 8/22 | က | Reference | | 0. 226 | 1.57 | 3.18 | 1.57 | 0.392 | 0. 137 | 4.2 |
| 4 | 8/22 | က | Tail Rotor Unbalance (2 Wraps) | Assume | 0. 588 | 3.14 | 4.9 | 2. 25 | 0.54 | 0.142 | 7.1 |
| n) | 3/20 | ო | * | | I | 0.392 | 0.353 | 0.465 | 0. 23 | | 96 U |
| r | 3/23 | က | Reference | | 0.167 | 0.44 | 0. 416 | 0.565 | 0. 269 | 0.108 | 1.32 |
| , | 3/28 | ဧ | Tail Rotor Unbalance (2 Wraps) | Assumed | 0.785 | 0. 49 | 0.44 | 0.687 | 0.343 | 0.108 | 1.47 |
| ď | 8/23 | 3 | Reference **** | | 0.108 | 0. 269 | 0.245 | 0.178 | 0.103 | 0.107 | 0.54 |
| | | | | | | | | | | | |

| ı | SEC | SECTION E | S (Cont 'd.) | | MALFUR | ICTION | MALFUNCTION TEST DATA-ALARM TAIL VIBRATION (Cont ⁱ d. | TA-AL | ARM IA | VIL VIBE | ATION | (Cont.'d.) |
|-----|------|-----------|---|---------|----------------------|--------|--|---------|---------|-----------------------------|--------|------------|
| | | | | INDIC | D | ATA RE | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | AS VEC | TOR VE | LOCITY | (IN/SE | ĵ |
| | DATE | DATE CODE | CONDITION(S) | | 20-40~ 40-80~ 80-160 | 40-80∼ | | 160-320 | 320-500 | 160-320320-500 500-1KC1-2KC | 1-2KC | ALL |
| | 8/23 | က | Tail Rotor Unbalance (2 Wraps) | Assumed | 0.588 | 0.882 | 0,735 | 0. 245 | 0.157 | 0.108 | | 1.23 |
| | 8/31 | 4 | | | | 0.34 | 0.29 | 0. 22 | | 0.12 | 0.14 | 0.70 |
| L | 8/31 | 4 | Reference | | 0.137 | 0.39 | 0.34 | 0.29 | 0.12 | 0.11 | 0.11 | 0.69 |
| . 8 | 8/31 | 4 | Short Shaft Misalignment (0.011") | | 0.145 | 0. 49 | 0.365 | 0.27 | 0.145 | 0.125 | 0.125 | 0.73 |
| | 8/31 | 4 | Short Shaft Misalignment (0.023") | | 0.14 | 0.34 | 0. 29 | 0.22 | 0.11 | D. 12 | 0.14 | 0.70 |
| | 9/5 | 4 | Short Shaft Misalignment (0. 23") | | 0.115 | 0.34 | 0. 255 | 0.22 | 0.11 | 0.1 | 0.11 | 0.60 |
| | 9/5 | 4 | V-Band Coupling, Loss of Torque $(150^{\circ}\#)$ | | i | | | | | | | 0.64 |
| | 9/5 | 4 | V-Band Coupling, Loss of Torque (0'#) | | | | | i | | | | 0.68 |
| | 9/6 | 41 | Reference ('Bishop's Hat'' Installed) | | 0.12 | 0. 29 | 0.29 | 0.22 | 0.11 | 0.11 | 0.12 | 0.64 |
| J | | | | | | | | 1 | l | | | Children |

| <u>`</u> | | ., | | | | | | /, . | | | 98 CP11 6 06 |
|--|---|---|--|------------------------------|---|--|-------------------------------------|---------------|-----------|-----------------------------------|----------------------------------|
| Cont | (C) | ALL | 0.59 | 0.64 | 0.59- | 0.64 | 0.63 | 0.73- 0.78 | 0.68 | 1.46 | 0.98 |
| ATION | (IN/SE | 1-2KC | | | | | 0.175 | 0.117 | 0.117 | 0.117 | 0.106 |
| IL VIBE | LOCITY | 500-1KC | | | | | 0.185 | 0.12 | 0.13 | 0.12 | 0.125 |
| ARM TA | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | NOTED 20-40~ 40-80~ 80-160 160-320320-500 500-1KC 1-2KC | | | | | 0. 22 | 0.195 | 0.155 | 0.185 | 0.195 |
| TA-AL | AS VEC | 160-320 | | | | | 0.54 | 0.33 | 0.29 | 0.37 | 0.34 |
| TEST DA | CORDEL | 80-160 | | | | | 0.495 | 0.245 | 0.27 | 0.54 | 0.39 |
| MALFUNCTION TEST DATA-ALARM TAIL VIBRATION (Cont'd.) | ATA RE | 40-80∼ | | | | | 0. 495 | 0.34 | 0.29 | 0.62 | 0.49 |
| MALFUN | Ď | 20-40∼ | | | | | 0.46 | 0.11 | 0.12 | 0.49 | 0.29 |
| | INDIC | NOTED | | | | - | nvalid Data | | | Yes | Yes |
| ; (Cont 'd.) | | CONDITION(S) | 'Bishop's Hat'' Mounting Bolt @ O Torque. | V-Band Coupling, O Torque | NII Turbine Unbalance (180 ⁰ Orientation) | NII Turbine Unbalance (90 ⁰ Orientation) | Tail Rotor Drive Shaft Unbalance | Reference | Reference | Tail Rotor Unbalance (2 Wraps) | Tail Roto: Enbalance (1 Wrap) |
| SECTION E | 400 | CODE | 4 | 4 | 4 | -74 | 7 | 71 | -11 | rļ t. | 44 |
| SEC | | DAIE | 9/6 | 2/6 | 9/12 | 9/14 | 9/18 | 10/12 | 10/12 | 10-12 | 10/13 |
| • | | | | | | 8 | 6 | | | | |

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| \sim | | | | | | | | فيستبسي | | | |
|--|---|-----------------------------|-----------|-----------|---|--------------------------------|-----------|-----------|--|-------------------------------|-----------|
| MALFUNCTION TEST DATA-ALARM TAIL VIBRATION (Cont'd.) | 5 | ALL | 0.73 | 0.83 | 0.73 | 0. 49 | 0.88 | 0.83 | 0.85 | 0.83 | 0.98 |
| MATION | (IN/SE | 1-2KC | 0.117 | 0.12 | 0.39 | 0.175 | 0.13 | 0.106 | 0.12 | 0.12 | 0.117 |
| ALL VIBE | LOCITY | 160-320320-500500-1KC 1-2KC | 0.125 | 0.12 | 0. 40 | 0. 255 | 0. 125 | 0.11 | 0.12 | 0.125 | 0.13 |
| ARM TA | TOR VE | 320-500 | 0.175 | 0.195 | 0. 42 | 0. 235 | 0.17 | 0.185 | 0.15 | 0.145 | 0.165 |
| ATA-AL | AS VEC | 160-320 | 0. 28 | 0.37 | 0. 43 | 0. 29 | 0.37 | 0.44 | 0.29 | 0.33 | 0.46 |
| TEST DA | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | 80-160 | 0.34 | 0.32 | 0.245 | 0. 245 | 0.32 | 0.29 | 0. 255 | 0. 27 | 0. 29 |
| NCTION | ATA RE | 40-80~ | 0.34 | 0.39 | 0. 29 | 0. 29 | 0. 42 | 0.37 | 0.48 | 0. 42 | 0.39 |
| MALFU | ũ | $20 - 40 \sim$ | 0.106 | 0.136 | 0.132 | 0.12 | 0.136 | 0.136 | 0.145 | 0.165 | 0.136 |
| | INDIC | NOTED 20-40~ 40-80~ | | | | | | | | | |
| (Cont 'd.) | | CONDITION(S) | Reference | Reference | 42 ⁰ Gear Box Misaligned (1/2") | 42° Gear Box Misaligned (1/2") | Reference | Reference | Plugged Oil Collector, 42° Gear Box | Short Shaft Misalign- ment | Reference |
| SECTION E | | 3 000 | 44 | 4B | 4B | 4B | 4B | 4B | 4C | 4C | 40 |
| SECT | | DAIE | 10 /13 | 10/16 | 10/16 | 10/16 | 10/16 | 10/17 | 10/18 | 10/18 | 10/19 |

| SEC | SECTION E | (Cont'd.) | | MALF | MALFUNCTION TEST DATA-ALARM TAIL VIBRATION (cont'd | V TEST | DATA-A | LARM T | AIL VIB | RATION | (cont 'd |
|-------|-----------|---|-------|--------|--|--------|---------|------------|--------------|--------|----------|
| DATE | DATE CODE | CONDITIONS | INDIC | ш | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | CORDE | D AS VE | CTOR VI | ELOCITY | (IN/SE | (0 |
| | | | NOTED | 20-40~ | 20-40~ 40-80~ 80-160 160-320320-500500-1KC 1-2KC | 80-160 | 160-320 | 320-500 | 500-1KC | 1-2KC | ALL |
| | | | | | | | | | | | |
| 10/20 | 40 | Reference | | 0.145 | 0.39 | 0. 29 | 0.39 | 0.145 | 0.12 | 0.125 | 0.83 |
| 10/21 | 4C | SAE #30 Oil in 42 ⁰ Gear Box | | 0.136 | 0.46 | 0.32 | 0.37 | 0.98 | 0. 106 | 0.117 | 60 0 |
| 10/23 | Ð | Annealed Input Quill Gear and Bearing in 42 ⁰ & 90 ^o Gear Boxes | | 0.14 | 0. 42 | 0.28 | 0. 29 | 0.15 | 0. 136 | 0 10 | |
| 10/93 | Ę | High Frequency Tail Vib- | | 1-2KC | 2-4KC | 4-8KC | | | | | |
| 3/2 | ┵ | ration | | 0.106 | : | - | : | | | | |
| , | | *** | | | | | | | | | |
| 10/24 | 4 | New Pick-up Location | | | | | | | | | |
| | | | | | | | | | | | |
| 10/24 | 4D | Annealed Input Quill Gear and Bearing in 42° & 90° Gear Boxes | Yes | 0.195 | 0. 49 | 0.49 | 0. 29 | 0.125 | 0.195 | 0 20 | · 8 |
| 10/24 | 40 | Annealed Input Quill Gear and Bearing in 42° & 90° Gear Boxes | Yes | 0. 215 | 0.44 | 0.49 | 0. 27 | 1 —— | | 1 | 60 |
| 10/24 | 4D | High Frequency Tail Vib- ration | ¦ | 2-20KC | | | | | | | |
| | | | | | | | | | | | |

**** CEC-4-118 Vibration Pick-Up Installed $\approx 30^{o}$ From Vertical on 90^{o} Gear Box

| SEC | TION E | SECTION E (Cont'd.) | | MALFU | NCTION | TEST | ATA-AI | MALFUNCTION TEST DATA-ALARM TAIL VIBRATICM (Cont'd. | AIL VIBI | RATION | (Cont'd.) |
|---------|-----------|---|----------------|----------------------|---------------|--------|---------|---|----------|---------------|-----------|
| | | | INDIC | D, | DATA RECORDED | CORDEL | AS VEC | AS VECTOR VELOCITY | LOCITY | (IN/SEC) | i i |
| DATE | DATE CODE | CONDITION(S) | NOTED | 20-40~ 40-80~ 80-160 | 40-80∿ | | 160-320 | 160-320 320-500 500-1KC1-2KC | 500-1KC | 1-2KC | ALL |
| 10/24 | 4D | Annealed Input Quill Gear and Bearing in 42 ⁰ and 90 ⁰ Gear Boxes | Reset Sens. | 0.195 | 0.34 | 0.42 | 0. 27 | 0.125 | 0.38 | 0.32- 0.73 | 96.0 |
| 10/24 | 40 | Annealed Input Quill Gear and Bearing in 42° & 90° Gear Boxes | | 0.195 | 0.37 | 0.42 | 0.27 | 0.125 | 0.28 | 0.32- 0.73 | 0.98 |
| 10/25 | ξ 4D | Annealed Input Quill Gear and Bearing in 42° & 90° Gear Boxes | | 0.195 | 0.37 | 0. 42 | 0.28 | 0.12 | 0. 245 | 0. 49 | 0.98 |
| ω 10/25 | 5 4D | Tail Rotor Unbalance (2 Wraps) | Yes | 1.18 | 0.98 | 0.78 | 0.34 | 0.145 | 0.195 | 0.39 | 1.21 |
| 10/25 | 4D | Tail Rotor Unbalance (1 Wrap) | Yes | 0.64 | 0.54 | 0.54 | 0.30 | 0.125 | 0. 215 | 0.34 | 1. 21 |
| 10/25 | CP CP | Tail Rotor Unbelance (1/2 Wrap) | ¥e | 0.49 | 0. 49 | 0.49 | 0. 225 | 0.12 | 0.195 | 0.34 | 1.02 |
| 10/25 | 4D | Reference | | 0.205 | 0. 42 | 0.49 | 0.34 | 0.125 | 0.235 | 0.34 | 0.98 |
| 10/30 | 4D | 42º Gear Box Failure (1) | Yes | 0. 225 | 0.31 | 0.78 | t. 44 | 0.165 | 0.32 | 0.54 | 0.88 |
| 10/30 | 4D | 42 ⁰ Gear Box Failure (2) | Yes | 0.235 | 0.34 | 0.78 | 0.44 | 0.136 | 0.32 | 0.54 | 1.18 |

| SEC | JON E | SEC JON E (Cont d. , | | MALFU | NCTION | TEST D | ATA-AL | ARM TA | MALFUNCTION TEST DATA-ALARM TAIL TIBRATION (COTO). | ATION | Court d. |
|-------|-------------------|--|-------|---------------|--------|--------|----------------|--------------------|--|-------------------|-------------|
| | | | LADIC | D. | ATA RE | CORDEL | AS VEC | TOR VE | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | (IN/SE | C) |
| DAE | DATECODE | CONDITION(S) | NOTED | 20-40~ 40-80~ | 40-80~ | 80-160 | 160-320 | 320-500 | 160-320 320-500 500-1KC 1-2KC | 1-2KC | ALL |
| | | 420 Gear Box | | | | | | | | | |
| 10/30 | 40 | Failure (3) | Yes | 0.245 | 0.34 | 0.78 | 0.44 | 0.165 | 0.27 | 0.54 | 1.21 |
| 10.30 | - | 42° Gear Box Failure (4) | Yes | 0.22 | 0.34 | 0.85 | 0. 49 | 0.155 | 0. 28 | 0.54 | 1.21 |
| 10,30 | 0 Q | 42 ⁰ Gear Box Failure (5) | Yes | 0.245 | 0.34 | 0.85 | 0.49 | 0.155 | 0.34 | 0.59 | 1.36 |
| 10.30 | 0 4E | Reference (42 ⁰ GB Replaced) | | 0.245 | 0.59 | 0. 44 | 0. 22 | 0.098 | 0. 195 | 0.27 | 0.98 |
| 16,81 | 1 46 | Reference | | 0.26 | 0.54 | 0.54 | 0. 225 | 0.098 | 0.17 | 0. 27 | 1.03 |
| 10/31 | 4. E. | Reference | | 0.245 | 0.54 | 0.54 | 9. 22 | 0. 0s _o | 0.17 | 0. 29 | ن ن ن |
| 19/31 | B | Tail Roton Orive Shaft Unbalance | | 0. 22 | 0.46 | 0.46 | (2 <u>∔</u> 5 | c. 098 | 0.27 | 0. 1 9 | 0.97 |
| 16/3 | 9 | Tail Rotor Drive Sheft Unbalance | | 0.22 | 0.42 | 0.49 | 0. 22 | 0.098 | 0. 27 | 0.37 | 9. 93 |
| 10/31 | 1 4E | Main Rotor Out o! Track | | 0.22 | 0.54 | Ú. 54 | 0. 22 | 0.098 | 0.195 | 0. 27 | 0.98 |

| nt d. | ALL | 0.93 | L | | 1.08 | 1.02 | 0.98 | 81 | 1.18 | 1.08 |
|--|---|----------------------------|-------------------------------------|-------------------------------------|--|---------------------------------------|--|---|---|---|
| ပ္ဆိုင္မ | | | 1.7 | 1.7 | | , j | | 1.18 | <u> </u> | |
| ATION / | 1-2KC | 0. 205 | 0. 37 | 0. 37 | 0. 27 | 0. 27 | 0. 27 | 0.59 | 0.54 | 0.54 |
| IL VIBR | 30-1KC | 0. 205 | 0. 22 | 0. 22 | 0.185 | 0.185 | 0. 195 | 0. 44 | 0.37 | 0.34 |
| RM TA | 320-500 | 0.195 | 0.106 | 0.10 | 0.11 | 0.098 | | 0.155 | 0.12 | 0.117 0.34 |
| TA-ALA | 160-320 | 0.195 | 0. 27 | 0. 274 | 0. 22 | 0. 225 | 0. 22 | 0.32 | 0.245 | 0, 235 |
| DATA BECORDED AS VECTOR VELOCITY (IN/SEC) | 30-160 | 0.46 | 0.68 | 0.68 | 0.46 | 0. 49 | 0.44 | 0. 42 | 0.44 | 0.44 |
| CTION 1 | ~08-01 | 0.54 | 1.18 | 1.12 | 0.54 | 0.54 | 0.54 | 0.39 | 0.46 | 0.46 |
| MALFUNCTION TEST DATA-ALARM TAIL VIBRATION (Contid.) | 20-40~ 40-80~ 80-160 160-320 320-500 500-1KC 1-2KC | 0.22 | 0.39 | 0.37 | 0. 205 | 0. 215 | 0.195 | 0. 29 | 0.195 | 0. 22 |
| | NOTED | | Yes | Yes | | | | Yes | Yes | Yes |
| E (Cont'd.) | CONDITION(S) | Main Rotor Out of Track | Drive Shaft Unbalance (23 Grams) | Drive Shaft Unbalance (23 Grams) | Tail Rotor Out of Track (2 Turns-PCL) | Tail Rotor Out of Track (2 Turns-PCL) | Tail Rotor Out of Track (2 Turns-PCL) | Loss of Oil - 90 ⁰ Gear Box | Loss of Oil - 90 ⁰ Gear Box | Loss of Oil - 90 ⁰ Gear Box |
| ION | CODE | 4E | 4E | 4E | 4E | 4E | 4E | 4E | 4E | 4E |
| SECTION | DATE CODE | 10/31 | 10/31 | 10/31 | 10/31 | 10/31 | 10/31 | 10/31 | | 10/31 |

| ECT | 1, | (Cont. | | A.2. 11 | NCTION | TEST D | AFLEUNCTION TEST DATA-ALARM TAIL VITATION (CENTRO) | ARM TA | IL VE.A | ATICN (| C: 11 'a.) |
|-------|-----------|--|-------|---------|---------------------------|--------|--|---------|---------|---------|-------------|
| | | | INDIC | Q | ATA RE | CORDEL | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | TOR VE | LOCITY | (IN/SE | C) |
| DATE | DATE CODE | CONDITION(S) | NOTED | 20−40~ | NOTED20-40~ 40-80~ 80-160 | | 160-320320-500 500-1KC1-2KC | 320-500 | 500-1KC | 1-2KC | ALL |
| | | | | | | | | | | | |
| 10/31 | i T | Reference (90 ⁰ GB Reserviced) | Yes | 0.32 | 0.64 | 0.59 | 0. 215 | : | D. 22 | 0. 42 | 1.2 |
| | | | | | | | | _ | | | |
| 10/31 | 4E | Reference | Yes | 0.28 | 0.59 | 0.54 | 0. 22 | | 0. 215 | 0.39 | 1.2 |
| 11/1 | 4E | Tail Rotor Re-Tracked | | 0.245 | 0.54 | 0.49 | 0. 22 | 0.098 | 0.185 | 0.37 | 1.18 |
| - | 4F. | Reference | | 0.245 | 0.54 | 0.54 | 0. 245 | 0.12 | 0.175 | 0. 27 | 1.18 |
| | | | | 1 | | | | ı | | | |
| 1.1 | 4E | Tail Rotor Unhalance (1 Wrap) | Yes | 0.83 | 0.78 | 0.64 | 0. 245 | 0.117 | 0.145 | 0. 215 | 1.56 |
| .; | 4E | Tail Rotor Unbalance (1/2 Wrap) | Yes | 0.49 | 0.59 | 0. 49 | 0. 235 | 0.34 | 0.185 | 0.34 | 7: |
| 11,1 | H | Tail Rotor Unbalance (1,2 Wrap) | Yes | 0.49 | 0.59 | 0.49 | 0. 215 | ! | 0.195 | 0.37 | 1.2 |
| 11/1 | 1 | Reierence | | 0. 235 | 0. 49 | 0.46 | 0. 22 | 1 | 0. 225 | 0. 42 | 1.12 |
| (1/1 | 4E | Reference | | 0.245 | 0.54 | 0.46 | 0. 21 | 1 | 0. 20 | 0. 42 | 1.12 |

| TON E (Cont | (Cont 'd.) | | IMDIC | MALFU | NCTION ATA RE | UNCTION TEST DATA-ALARM TAIL VIBRATION (C DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | ATA-AL | ARM TA | IL VIBE | (IN/SE | MALFUNCTION TEST DATA-ALARM TAIL VIBRATION (Cont'd.) DATA RECORDED AS VECTOR VELOCITY (IN/SEC) |
|--|---|------------------------|-------|--------------|------------------|--|------------------------------|---------|---------|--------|--|
| DATE CODE CONDIT | | CONDITION(S) | NOTED | NOTED 20-40~ | 40-80~ 80-160 | 1 | 160-320 320-500 500-1KC1-2KC | 320-500 | 500-1KC | 1-2KC | ALL |
| 4E Reference | Reference | | | 0. 245 | 0. 54 | | 0. 29 | - | 0. 20 | 0. 37 | 1.12 |
| Loss of Oil Box | s of Oil | - 90 ⁰ Gear | | 0.245 | | 0. 42 | 0. 235 | 0.106 | 0.32 | 0.54 | 1.12 |
| s of Oil | s of Oil | - 90 ⁰ Gear | | 0. 225 | 0.49 | 0. 44 | 0.245 | 0.125 | 0. 29 | 0. 49 | 1.08 |
| Loss of Oil - | s of Oil | . 90° Gear | Yes | 0. 205 | 0. 42 | 0. 49 | 0,34 | 0.22 | 0. 49 | 0. 54 | . 1.31 |
| 90 ⁰ Gear Box 4E Re-Serviced | 90° Gear Bo Re-Serviced | × | | 0. 22 | 0. 49 | 0.49 | 0.245 | 0.098 | 0.165 | 0.32 | 1.02 |
| 4E Reference | Reference | | | 0.245 | 0.54 | 0.54 | 0.32 | 0.106 | 0.145 | 0. 29 | 1.18 |
| 4E Low Oil Leve | Low Oil Lev | el - XMSN | | 0. 22 | 0.49 | 0.54 | 0.28 | 0.136 | 0.17 | 0.34 | 1.08 |
| 42 ⁰ Gear Box 4F (Annealed I/Q | 42 ⁰ Gear Bc (Annealed I/ | x (9) Installed | | 0.225 | 0.54 | 0.59 | 0.39 | 0.145 | 0. 22 | 0.34 | 1.18 |
| 4F Reference | Refe rence | | | 0. 22 | 0. 49 | 0.54 | 0.44 | 0.17 | 0. 22 | 0.37 | 1.21 |
| | | | | | | | | | | | |

| (| SECTION F. | Ī | 0.000 | | MALFUN | NCITO | EST D | MALETUNCTION " EST DO TA-ALARM TALL (IERATION (CORE), | NRM TA | HOLY TO | A_ION (| Chat. 7 |
|--------------|------------|----------|---|--------------|---------------|---------------|------------------|---|---------|---------|-----------------------------|---------|
| _ | Į. | ; ; | | isnic | D, | DATA RECORDED | CHOED | AS VEC | TOR VE | LOCITY | AS VECTOR VELOCITY (IN/SEC) | 5 |
| **** | EVALE | DATE COL | CONET TON(S) | NOTED | 20-40~ 40-80~ | | к0 –1 60 | 160-320 320-500 500-1KC1-2KC | 320-500 | 500-1KC | 1-2KC | ALL |
| | | | | | | | | | | | | |
| | 11 % | 4G | Re-Annealed 90º Gear Box I/Q Gear | | 0.185 | 0.39 | 0.44 | 0.32 | 0. 205 | 0.34 | 0.54 | 1.12 |
| | | | Re-Annealed 90° Gear | | | | | | | | | |
| ^ | 11/8 | 4G | Box I/Q Gear | | 0.195 | 0.37 | 0.42 | 0.275 | 0.205 | 0.32 | 9.64 | 217 |
| | 11/8 | 4G | Loss of Oil – 90 ⁰ Gear Box (1) | Yes | 0.195 | 0.39 | 0.44 | 0.34 | 0.195 | 0.34 | 0.68 | 1.21 |
| | 11/8 | 46 | Loss of Oil - 90° Gear Box (2) | Yes | 0. 235 | 0.39 | 0.44 | 0.29 | 0.195 | 0.34 | 0.73 | 1.21 |
| 4 | 11/8 | 46 | Loss of Oil - 90 ⁰ Gear Box (3) | Yes | 0. 205 | 0.39 | 2.0 | 0.32 | 0.195 | 0.34 | 0.68 | 1.21 |
| | 11 | H. | saied Input Juil) G | | 0. 195 | 0.32 | 0.37 | 0.37 | 0.32 | 0.46 | 0.49 | 1.13 |
| - | | | NDITION ('ODE | DESIGNATION: | TION: | | | | | | | |
| | | | 1. Flight Test Conponents (450 GB-SNA13-12) | D 024) | 3-SNA13 | -12) (90 | (90° GB-SIR13-15 | (A13-15) | | | | |
| | | | | placed | | | | | | | | |
| | | | 3 | 1000 | | | | | | | | |

4.7

| | THON E | SECTION E (Cont'd.) | | MALFUR | MALFUNCTION TEST DATA-ALARM TAIL VIBRATION (Cont'd. | rest D | TA-AL | LRM TA | IL VIBR | ATION (| Cont 'd.) | |
|----|-----------|--------------------------------|----------------------|----------------------------|---|--------|-----------------|---------|---------|---------|-----------|---------------------|
| | - G | | INDIC | α | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | CORDE | AS VEC | TOR VE | LOCITY | (IN/SE | (3) | |
| \$ | DATE CODE | CONDITION(S) | NOTED | NOTED 20-40~ | 40-80~ 80-160 160-320 320-500 500-1KC1-2KC | 80-160 | 160-320 | 320-500 | 500-1KC | 1-2KC | ALL" | |
| | | | | | | | | | | | | |
| | - | 3. Engine Replaced | | | | | | | | * | | |
| | | 4. XMBN Replaced | | _ | | | | | | | | |
| | | | | | | , | | | , | | | , , , , <u>,</u> |
| | - | 4A. 4Z GB-SNA13-68 IM | pelle | | | | | | | | | |
| 9 | | 4B. 42º GB-SNA13-12 installed. | talled. | | | | | | | | | |
| 5 | | 4C. 42º GB-6NA13-68 In | D) polluq |) pe zi ini | nalled (Plugged Oil Collector) | tor) | | , | | | | |
| | | 42° GB-SNA13-68. 9 | o GB-8 | O GB-SKA13-90 Ingtalle | Installed | Annea | (Annealed Incut | Ouill G | are B | | | |
| | | | | | | | | | | 1 | | |
| | | 4E. 42° GB Failure (SNA | 3 -6 8) S | A13-68) SNA13-12 Installed | Installed | | | · | , | | | |
| | | 4F. 42º GB SNA13-68 Inch | alled | | | | | | | , | | |
| | | | | | | | | | | | 3 | |

| | | | | | ويراوي المراوي المراوي | | | | |
|-----------------|--|---|---|---|--|--|--|---|--|
|) AI.I. | | | | | | | | | |
| (IN/SE) | | | | | | | | | |
| LOCITY m-1KC | | | | | | | | | |
| TOR VE | | | | | | | | | |
| AS VEC | stalled | | | | | | | | |
| CORDED | nd and In | Reptac | | | | | | | |
| ATA RE | eanneal | 6418-80 | | | , | | | | |
| D, | 13-90) E | . CD-6 | | | | | | | |
| INDIC | GB-SNA | Gear (90 | | | | | | | |
| NDITION(S) | out Quill Gear (900 | nealed Input Quill | | · | | | | | |
| CO | 4G. Inc | 4H. An | | | | | | | |
| CODE | | | | | | | | | |
| DATE | | | _ | | | | | | |
| | DATE CODE CONDITION(S) NOTED 20-40~ 40-80~ 80-160 1.60-2304220-5004m-1 KC 1-2 KC At I. | CONDITION(S) INDIC NOTED NOTED 4G. Input Quill Gear (90° GB-SNA | CONDITION(S) INDIC NOTED 4G. Input Quill Gear (90° GB-SNA 4H. Annealed Input Quill Gear (90 | CONDITION(S) INDIC NOTED 4G. Input Quill Gear (90° GB-SNA 4H. Annealed Input Quill Gear (90 | DATE CODE CONDITION(S) INDIC NOTED 4G. Input Quill Gear (90° GB-SNA 4H. Annealed Input Quill Gear (90 | CONDITION(S) NOTED 20-40~ 40-80~ 80-160 160-230 220-500 FTC 1-2KC AL 4G. Input Quill Gear (90° GB-SNA13-90) Reannealed and Installed 4H. Annealed Input Quill Bear (90° GB-SNA13-90) Asptaced | DATE CODE CONDITION(S) NOTED AG. Input Quill Gear (90° GB-SNA13-90) Reannealed and Installed 4G. Input Quill Gear (90° GB-SNA13-90) Reannealed and Installed 4H. Annealed Input Quill Gear (90° GB-SNA13-90) Reannealed and Installed AH. Annealed Input Quill Gear (90° GB-SNA13-90) Reannealed and Installed AH. Annealed Input Quill Gear (90° GB-SNA13-90) Reannealed and Installed AH. Annealed Input Quill Gear (90° GB-SNA13-90) Reannealed and Installed AH. Annealed Input Quill Gear (90° GB-SNA13-90) Reannealed and Installed | DATE CODE CONDITION(S) INDIC DATA RECORDED AS VECTOR VELOCITY (IN/SEC) NOTED 20-40-40-60-80-160 140-200 220-500 500-1KC 1-2KC AL 4G. Input Quill Gear (90° GB-SNA13-90) Reamenied and Installed 4H. Annealed Input Quill Gear (90° GB-SKA18-60) Representation of the control of | DATE CODE CONDITION(S) NOTED 20-40~ 40-60~ 60-160 160-220/2-0.0 50-100 160-220/2-0.0 50-100 50- |

MALFUNCTION TEST DATA-ALARM LOW FREQUENCY MAST VIBRATION

| SECTION F | ON F | | | | | LOW FREQUEN | EQUEN | CY MAST | LOW FREQUENCY MAST VIBRATION | TION | |
|-----------|------|--|-------|-------|--------|---------------|-------|---------|------------------------------|---------|----|
| | | | INDIC | Ω | ATA RE | DATA RECORDED | | TOR VE | AS VECTOR VELOCITY (IN/SEC) | (IN/SEC | 3) |
| DATE | CODE | CONDITION(S) | NOTED | . 2-3 | 3-6 | 6-12 | 12-25 | 25-50 | 20-100 ALL | ALL | |
| 2/8 | | Reference | , | 0.135 | 0.135 | 0.189 | 0.162 | 0.108 | 0.243 | 0.54 | |
| 8/8 | г | Reference | | <.10 | 0.139 | 0.278 | 0.203 | 0.134 | 0.267 | 0.588 | |
| 6/8 | 1 | Reference | | | 0.107 | 0.214 | 0.182 | 0.107 | 0.160 | 0.374 | |
| 8/10 | -1 | Reference | | <.10 | 0.118 | 0.214 | 0.187 | 0.134 | 0.241 | 0.428 | |
| 8/10 | 1 | Main Rotor Unbalance (1 Wrap - 2" Tape- W/Y) | | <.10 | 0.128 | 0.161 | 0.134 | 0.107 | 0.171 | 0.374 | |
| 8/10 | 1 | Main Rotor Unbalance (1 Wrap-2" Tape-R/Y | Yes | <.10 | 0.188 | 0.209 | 0.134 | 0.107 | 0.171 | 0.428 | |
| 8/10 | 1 | Main Rotor Unbalance (2 Wrap-2" Tape R/Y) | Yes | 0.107 | 0.348 | 0.321 | 0.187 | 0.118 | 0.161 | 0.643 | |
| 8/10 | 1 | Main Rotor Unbalance (3 Wrap-2" Tape R/Y) | Yes | 0.107 | 0.386 | 0.332 | 0.187 | 0.107 | 0.161 | 0.803 | |
| 8/15 | 2 | Reference (XMSN & Main Mast Replaced) | Yes | .10 | 0.193 | 0.268 | 0.145 | 0.134 | 0.268 | 0.535 | |

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MALFUNCTION TEST DATA-ALARM LOW FREQUENCY MAST VIBRATION (Cont'd)

SECTION F (Cont'd)

| | L | | D.C. | | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | CORDED | AS VEC | TOR VE | LOCITY | (IN/SEC | |
|--------|-----------|---|----------------|-------|---|--------|--------|--------|--------|---------|---|
| DATE | DATE CODE | CONDITION(S) | N TED | . 2-3 | 3-6 | 6-12 | 12-25 | 25-50 | 50-100 | ALL | |
| 8/15 | 2 | Reference | Reset Sens. | 0.107 | 0.193 | 0.241 | 0.134 | 0.134 | 0.268 | | |
| 8/15 | 2 | Main Rotor Unbalance (3 Wraps-W/Y) | | 0.107 | 0.161 | 0.225 | 0.187 | 0.107 | 0.241 | 989.0 | |
| 8/15 | 2 | Main Rotor Unbalance (3 Wraps-R/Y) | | <.10 | 0.268 | 0.236 | 0.187 | 0.171 | 0.268 | 0.59 | _ |
| 8/15 | 73 | Tail Rotor Unbalance (2 Wraps) | Yes | <.10 | 0.139 | 0.241 | 0.214 | 0.246 | 0.375 | 65.0 | |
| T7/8 | গ | Reference (Lo Pa ss Filter Installed) | | <.10 | 0.118 | 0.107 | <.10 | < . 10 | <.10 | 0.193 | |
| 8/23 | 87 | Tail Rotor Unbalance (2 Wraps) | | <.10 | 0.107 | < 0.10 | <.10 | <.10 | <.10 | 0.203 | |
| 8/23 | પા | Muin Rotor Unbalance (2 Wraps-R/Y) | | | | | | | | 0.294 | |
| 10/12 | 3 | Reference | | | 0.22 | 0.13 | | | | 0.30 | |
| 10, 12 | က | Kelerence | | | 0.175 | 0.12 | • | | - | 0.30 | |
| | | | | | | | | | | | |

98

| : | SECTION F | | (Cont'd) | | | | MALFI LOW F | UNCTIO | N TEST NCY MA | DATA-A ST VIBR | MALFUNCTION TEST DATA-ALARM LOW FREQUENCY MAST VIBRATION (Cont'd) | Cont'd) |
|------------------|-----------|------|-----------------------------------|-------|------|---|----------------|--------|------------------|-------------------|--|------------|
| - - - | E . | 600 | | INDIC | Ω | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | CORDEL | AS VEC | TOR VE | LOCITY | (IN/SE | 3) |
| | DATE | зпоэ | CONDITION(S) | NOTED | ,2-3 | 3-6 | 6-12 | 12-25 | 25-50 | 50-100 | ALL | |
| | , | | | | | , | , | | | | | |
| | 10/12 | 23 | Keierence | | ٠ | 0.175 | 0.12 | | | | 0.30 | |
| | 10/12 | ဗ | Main Rotor Unbalance (2 w-W/Y) | | | 0.16 | 0.11 | - | - | | 0.225 | |
| | 10/12 | 3 | Main Rotor Unbalance (2w R/Y) | Yes | | 0.25 | 0.14 | | | | 0.35 | |
| 9 | 10/12 | 3 | Main Rotor Unbalance (3w R/Y) | Yes | | 0.275 | 0.22 | | | | 0.375- | , |
| 9 | 10/13 | 3 | Reference | | | 0.175 | 0.10 | | | | 0.25 | |
| | 10/13 | 3 | Reference | | | 0.20 | 0.10 | | | | 0.275 | |
| | 10/16 | 3 | Reference | | | 0.20 | 0.125 | · | | | 0.25 | * ; |
| | 10/16 | 3 | Reference | | | 0.20 | 0.115 | | | | 0.30 | |
| | 10/17 | ဗ | Reference | | | 0.175 | 0.10 | | | | 0.275 | |

MALFUNCTION TEST DATA-ALARM LOW FREQUENCY MAST VIBRATION (Cont'd) SECTION F (Contide

| SECT | SECTION F | (Cont.a) | | | | T MOT | יים כאישער | UNI TON | LOW FREQUENCY MAST VIBRATION (CONT. 4) | WITT W | Court of |
|------------|-----------|--------------------------------|-------|------|----------------|--------|------------|---------|---|--------|----------------|
| | | | INDIC | a | ATA RE | CORDED | AS VEC | TOR VE | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | (IN/SE | (2) |
| DATE | CODE | CONDITION(S) | NOTED | .2-3 | 3-6 | 6-12 | 12-25 | 25-50 | 50-100 | ALL | |
| <u>-</u> . | , | | | | | | | | | | |
| 10/18 | က | Reference | | | 0.20 | 0.11 | | | | 0.275 | |
| 10/18 | က | Reference | | | 0.19 | 0.10 | | | | 0.275 | |
| 10/19 | m | Befarence | | | 0.10 | 0.11 | | | | 0.15 | |
| | <u> </u> | Main Rotor Unbalance (2wW/Y | | | 0.125- 0.16 | 0.10 | | | | 0.175 | |
| 30/30 | ю | Reference | | | 0.125 | <0.10 | | · | | 0.30 | • |
| 10/23 | က | Reference | | | 0.15 | 0.12 | | | | 6. 226 | 6 ₂ |
| 10/24 | м | Reference | | | 0.15 | 0.105 | | | | 0.225 | |
| 10/24 | က | Reference | | | 0.17 | 0.105 | | | | 0.225 | |
| 10/25 | က | Reference | | | 0.16 | 0.10 | | | | 0.225 | |
| | | | | | | | | | | | |

e.

MALFUNCTION TEST DATA-ALARM

| LOW FREQUENCY MAST VIBRATION (Cont'd) | (SEC) | - 1 | 0 | 25 | 57 | 9 | 5! | 9 | 25 | S | Ľ |
|---------------------------------------|---|--------------|---------------------------|---|---------------------|---------------------------|---------------------------------|---------------------------|-----------|---------------------------------|------------------------------|
| ATIO | (IN/ | ALL | 0.30 | 0.325 | 0.32 | 0.35 | 0.35 | 0.35 | 0.225 | 0.45 | 0.45 |
| ST VIBR | SLOCIT | 50-100 | | | | | | | | | |
| NCY MA | CTOR VI | 25-50 | | | | | | | | | |
| REQUE | AS VE | 12-25 | | | | | | | | | |
| LOW F | CORDEL | 6-12 | 0.125 | 0.105 | 0.13 | 0.13 | 0.14 | 0.12 | 0.115 | 0.17 | 0.17 |
| | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | 3-6 | 0.25 | 0.24 | 0,225 | 0.30 | 0.30 | 0.25 | 0.15 | 0.375 | 0.375 |
| | α | . 2-3 | | | | | | | | | |
| | INDIC | NOTED | Yes | Yes | Yes | Yes | Yes | Yes | | Yes | Yes |
| (Cont'd) | | CONDITION(S) | Uncentered Cyclic Control | Blade Set (Overtight Weekend Tie-Down) | Blade Set (2nd Run) | Uncentered Cyclic Control | Main Rotor Unbalance (2wR/Y) | Uncentered Cyclic Control | Reference | Main Rotor Unbalance (1wR/Y) | Main Rotor Unbalance (1wR/Y) |
| | 400 | 3000 | 3 | 3 | က | 3 | က | က | 3 | 3 | က |
| SECTION F | 200 | DATE | 10/25 | 10/30 | 10/30 | 10/30 | 01 00/30 | 10/30 | 10/31 | 10/31 | 10/31 |

MALFUNCTION TEST DATA-ALARM

| ויי | SECTION F | (Cont'd) | | | | LOW F | REQUE | NCY MA | LOW FREQUENCY MAST VIBRATION (Cont'd) | ATION (| Cont'd) |
|-------|-----------|--|--|--|---|--|--|--|--|--|---|
| 1 | 200 | | INDIC | Q | ATA RE | CORDED | AS VEC | TOR VE | SLOCITY | (IN/SE | (၁ |
| | CODE | CONDITION(S) | NOTED | . 2-3 | 3-6 | 6-12 | 12-25 | 25-50 | 50-100 | ALL | |
| 10/31 | 3 | Main Rotor Out of Track-4 Flats | Yes | | 0.475 | 0.175 | | | | 0.50 | |
| 10/31 | 3 | Main Rotor Out of Track-4 Flats | Yes | | 0.45 | 0.17 | | | | 0.475 | |
| 10/31 | | Main Rotor Out of Track-1 Flat | Yes | | 0.35 | 0.14 | | | | 0.40 | |
| 10/31 | 3 | Main Rotor Out of Track-1 Flat | Yes | | 0.34 | Ò. 145 | | | , | 0.425 | |
| 10/31 | 3 | Reference | | | 0.225 | 0.11 | | ! | | 0.30 | |
| 10/31 | 3 | Reference | | | 0.20 | 0.10 | | | | 0.25 | |
| 10/31 | 3 | Reference | | | 0.165 | 0.10 | | | | 0.20 | |
| 11/1 | 3 | Reference | | | 0.175 | 0.105 | | | | 0.225 | |
| 11/1 | | Reference | | | 0.19 | 0.11 | | | | 0.23 | |
| | | E CODE 1 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 | E CODE 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 | E CODE CONDITION(S) Main Rotor Out of Track-4 Flats Main Rotor Out of Track-1 Flats Main Rotor Out of Track-1 Flats Main Rotor Out of Track-1 Flat Reference Reference Reference Reference Reference Reference Reference Reference Reference Reference | CODE CONDITION(S) INDIC Log 3 Flats Main Rotor Out of Track-4 Yes 3 Flats Main Rotor Out of Track-1 Yes 3 Reference Yes 3 Reference Reference Reference 3 Reference Reference | CODE CONDITION(S) INDIC Log 3 Flats Main Rotor Out of Track-4 Yes 3 Flats Main Rotor Out of Track-1 Yes 3 Reference Yes 3 Reference Reference Reference 3 Reference Reference Reference Reference 3 Reference Refe | CODE CONDITION(S) INDIC Long 3 Flats Main Rotor Out of Track-4 Yes 3 Flats Main Rotor Out of Track-1 Yes 3 Flat Rotor Out of Track-1 Yes 3 Reference Reference Reference 3 Reference Reference 4 Reference Reference Reference 5 Reference Reference Reference Reference 6 Reference Ref | CODE CONDITION(S) INDIC Long 3 Flats Main Rotor Out of Track-4 Yes 3 Flats Main Rotor Out of Track-1 Yes 3 Flat Rotor Out of Track-1 Yes 3 Reference Reference Reference 3 Reference Reference 4 Reference Reference Reference 5 Reference Reference Reference Reference 6 Reference Ref | CODE CONDITION(S) INDIC Long 3 Flats Main Rotor Out of Track-4 Yes 3 Flats Main Rotor Out of Track-1 Yes 3 Flat Rotor Out of Track-1 Yes 3 Reference Reference Reference 3 Reference Reference 4 Reference Reference Reference 5 Reference Reference Reference Reference 6 Reference Ref | CODE CONDITION(S) INDIC Long 3 Flats Main Rotor Out of Track-4 Yes 3 Flats Main Rotor Out of Track-1 Yes 3 Flat Rotor Out of Track-1 Yes 3 Reference Reference Reference 3 Reference Reference 4 Reference Reference Reference 5 Reference Reference Reference Reference 6 Reference Ref | CODE CONDITION(S) INDIC DAILA TO COLDED AS VECTOR NEW COLD IN NOTED 2-3 3-6 6-12 12-25 25-50 50-100 3 Flats |

MALFUNCTION TEST DATA-ALARM LOW FREQUENCY MAST VIBRATION (Cont¹c)

| SO! | SECTION F | | (Cont'd) | | | | LOW F | REQUEN | ICY MA | ST VIBR | LOW FREQUENCY MAST VIBRATION (Cont'd) | Cont'd) |
|---|-----------|------|-------------------------------------|-------|------|---|--------|--------|--------|----------------|---------------------------------------|---------|
| <u> </u> | | [| | INDIC | 1 | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | CORDED | AS VEC | TOR VI | ELOCITY | (IN/SE | 6 |
| لن | DATE | CODE | CONDITION(S) | NOTED | .2-3 | 3-6 | 6-12 | 12-25 | 25-50 | 50-100 | ALL | |
| | 1/11 | က | Cyclic Beat | Yes | | 0.35 | 0.14 | | | | 0.475 | |
| | | | | | | | ŀ | | | | | |
| | 11/1 | 3 | Cyclic Beat | Yes | | 0.26 | 0.15 | | | | 0.30 | |
| | 11/11 | 3 | Main Rotor Unbalance (2w. – R/Y) | Yes | | 0.425 | 0.15 | | | | 0.475 | |
| 10 | 17/1 | 3 | Main Rotor Unbalance (2w R/Y) | Yes | | 0.425 | 0.15 | | | | 0.475 | |
| | 1/11 | 3 | Main Rotor Unbalance (1w R/Y) | Yes | | 0.325 | 0.14 | | | | 0.425 | |
| • | 11/11 | 3 | Main Rotor Unbalance (2w W/Y) | | | 0.17 | 0.10 | | | | 0.225 | |
| | 1/11 | က | Main Rotor Unbalance 2wW/Y) | | | 0.20 | 0.10 | | | | 0.275 | |
| | 1/11 | 8 | Main Rotor Unbalance 2wW/Y lwR/Y | Yes | | 0.44 | 0.17 | | | | 0.55 | |
| لتـــــــــــــــــــــــــــــــــــــ | 1/11 | က | Main Rotor Unbalance 2wW/Y 1wR/Y | Yes | | 0.55 | 0.20 | | | | 09.0 | |

MALFUNCTION TEST DATA-ALARM LOW FREQUENCY MAST VIBRATION (Cont'd)

| SECTION F | 1 | (Cont'd) | | | | LOW F | LOW FREQUENCY MAST VIBRATION (Contid) | NCY MA | ST VIBR | ATION (| Cont'd) |
|-----------|------|---|-------|-------|----------------------------------|--------|---------------------------------------|--------|---------|----------|---------|
| | 200 | | INDIC | Ω | DATA RECORDED AS VECTOR VELOCITY | CORDED | AS VEC | TOR V | LOCITY | (IN/SEC) | (၁ |
| DAIE | CODE | CONDITION(S) | NOTED | . 2-3 | 3-6 | 6-12 | 12-25 | 25-50 | 50-100 | ALL | |
| 1/11 | 3 | Main Rotor Unbalance 2wW/Y 1/2wR/Y | Yes | | 0.35 | 0.13 | | | | 0.35 | |
| 1/11 | | Main Rotor Unbalance 2wW/Y 1/2wR/Y | Yes | | 0.325 | 0.12 | | | | 0.34 | |
| 11/1 | 3 | 2 Balance Wraps-W/Y Blade | | | 0.22 | 0.10 | | | | 0.225 | |
| 11/1 | | 2 Balance Wraps-W/Y Blade | | | 0.24 | 0.10 | | | | ₩.0 | |
| 11/1 | က | 2 Balance Wraps-W/Y; Out of Track - 1 Flat, PCL | Yes | | 0.425 | 0.21 | | | | 9.55 | |
| 1/11 | က | Ав Аbove | Yes | | 0.425 | 0.19 | | | | 0.55 | |
| 11/3 | 3A | 2 Balance Wraps - W/Y Blade | | | 0.225 | 0.105 | | | | 0.25 | |
| 11/6 | 3B | 2 Balance Wraps - W/Y Blade | | | 0.15 | 0.10 | | | | 0.20 | |
| 11/7 | 3B | Balance Wraps Removed 1w. R/Y Blade | | | 0.175 | 0.10 | | | | 0.225 | |
| | | | | | | | | | | | |

MALFUNCTION TEST DATA-ALARM
TOW FREQIENCY MAST VIBRATION (Cont'd)

| SECTION F | | (Cont'd) | | | | LOW F | LOW FREQUENCY MAST VIBRATION (Contid) | NCY MA | ST VIBR | ATION (| Cont'd) |
|-----------|------|-------------------------------|-------|-------|--------|--------|---------------------------------------|--------|---|---------|---------|
| | | | INDIC | Ω | ATA RE | CORDED | AS VEC | TOR VE | DATA RECORDED AS VECTOR VELOCITY (IN/SEC) | (IN/SE | C) |
| DATE | CODE | CONDITION(S) | NOTED | . 2-3 | 3-6 | 6-12 | 12-25 | 25-50 | 50-100 | ALL | |
| 9 | g. | A/ 111 = 0/ + A/ 4 = == + | | | 10 | | | | • | 16 | |
| 2/11 | 35 | I W II, 1/2 W-W/I | | | | 1 | | | | 24:5 | |
| 11/8 | 3B | No Tape, Reference | | | 0.125 | 0.105 | | | | 0.185 | |
| 9/11 | 3B | Reference: ≈ in-Balance | | | 0.15 | 0.10 | | , | | 0.175 | , |
| 9/11 | 3B | Reference; $pprox$ in-Balance | | | 0.14 | 0.10 | | | | 0.175 | ų į |
| 11/9 | 3B | 1/2 Wrap Tape - Unicience | Yes | | 0.25 | 0.146 | | | | 0.296 | |
| 11/9 | 3B | 1/2 Wrap Tape - Unbalance | Yes | | 97.0 | 0.15 | | | ı | 0.36 | |
| 11/9 | 3B | 1 Wrap Tape - Unbalance | Yes | | 0.355 | 0.195 | | | | 0.55 | |
| 11/9 | 3B | 1 Wrap Tape - Unbalance | Yes | | 0.35 | 0.19 | | | | 0.55 | |
| | | | | | | | | | | | |

MALFUNCTION TEST DATA-ALARM

| <i>*1</i> (| SUCTI | ON F (| SECTION F (Cont'd) | | | MALFU LOW F | MALFUNCTION TEST DATA-ALAKM LOW FREQUENCY MAST VIBRATION | CY MAS | JATA-A ST VIBR | MALFUNCTION TEST DATA-ALAKM LOW FREQUENCY MAST VIBRATION (Cont'd) | Cont'd) | |
|-------------|-------|------------|---|-------|--------------|----------------|---|--------|-------------------|--|---------|-------|
| | ; | 5 | | INDIC | | DATA RECORDED | CORDEL | AS VEC | TOR VI | AS VECTOR VELOCITY (IN/SEC) | (IN/SE | 6 |
| | 3117 | ממסס ביוית | CONDITION(S) | NOTED | . 2-3 | 36 | 6-12 | 12-25 | 25-50 | 50-100 | ALL | |
| | | | CODE DESIGNATIONS: | | | | | | | | | |
| | | | 1. Flight Test Components (XMSN SN A12-20) | | | | | | | | | |
| <u> </u> | | | 2. XMSN & Main Mast Replaced (XMSN SN A12-142) | | | | | | | | | |
| 1 | 1 | | 3 X (SN Replaced (XMSN SN ALE-74) | | | | | | | | | |
| (96 | | | 3A Main Mand Pulled to Introduce 1015" Flut or Lower Bearing Race | | | | | | | | | |
| | | | 31'. Main Masi Pulled Pares ace Upper Planeta. Geo. System. | | | | | | | | | ***** |
| (| | | | | | | | | | | | |
| سيستسسد | | | | | | | | | | | | |
| • , | • | , | | | 1-10 100 100 | | | | | | | |
| | • | | | ; | | 1 | | 1 |] |] | | |

APPENDIX IV

OIL SAMPLE ANALYSES

The following samples of oil were filtered, and any material which was trapped on the filter paper was studied and tested.

| Sample | Date Taken | Source of Sample | Observation of the Residue on Filter Paper | Magnetic Particles |
|----------|----------------|---------------------------------|---|-----------------------|
| A | 9/6/61 A.M. | Transmission before ground runs | Numerous black spots and some metallic flakes | None |
| В | 9/6/61 | Transmission after 2 runs | Some black particles | None |
| C | 9/6/61 | Engine before ground runs | No particles visible | None |
| D | 9/6/61 | Engine | No particles visible | None |
| E | 9/7/61 | Transmission | Some black spots | None |
| F | 9/13/61 | Engine | No deposits visible | None |
| G | 9/13/61 | Transmission | Some black particles and metallic flakes | None |
| H | 9/15/61 | Engine | No deposits visible | None |
| I | 9/15/61 | Transmission | Some black particles | None |
| J | 9/25/61 | Engine | No particles visible | None |
| K | 9/25/61 | Transmission | Some black particles | None |
| L | 10/13/61 | Engine | Some black particles | None |
| M | 10/13/61 | Transmission | Many black particles and some metallic particles | None |
| N | 10/19/61 | Engine | Some black particles | None |
| O | 10/19/61 | Transmission | Some black particles | None |

| Sample | Date Taken | Source of Sample | Observation of the Residue on Filter Paper | Magnetic Particles |
|------------|-------------------------|---|--|--------------------------------|
| P | 10/20/61 2:00 P. M. | Engine | Some black particles | None |
| Q | 10/20/61 | Transmission | Some black particles | None |
| R | 10/24/61 | Engine | No particles visible | None |
| 8 | 10/24/61 | Transmission | Numerous black particles | None |
| T | 10/26/61 9:30 A. M. | Transmission | Numerous black particles | None |
| U, | 10/26/61 | Engine | No particles visible | None |
| V . | 10/26/61 | 42 ⁰ - 90 ⁰ Gear Box Detector Residue | Numerous black particles | None |
| w | 1Q/26/61 .11;00 A.M. | 42 ⁰ Gear Box | Many yellow non- magnetic particles. Spot tests show copper present. Black par- ticles are magnetic and give test for iron. | Black magnetic particles |
| X | 10/26/61 11:00 A.M. | 42 ⁰ Gear Box Flushings | Same as Sample W | . Same as Sample W |
| Y | 10/27/61 | 42 ⁰ Gear Box Serviceable Flushings | Many black particles and some metallic flakes | None |
| z | 10/27/61 | 90 ⁰ Gear Box Flushings | Many black particles and some yellow particles. Spot tests for iron and copper were negative | Few |
| 1,01 | 11/3/61 7:34 A. M. | Transmission | Some small black particles | None |
| 102 | 11/4/61 | 90 ⁰ Gear Box Flushings | Black gummy deposits | None |

| Sample | Date Taken | Source of Sample | Observation of the Residue on Filter Paper | Magnetic Particles |
|--------|---------------|--------------------------|--|-----------------------|
| 103 | 11/7/61 | 42 ⁰ Gear Box | Many metallic chips. Spot test shows iron present. | None |
| 104 | 11/8/61 | 90° Gear Box | Black deposit. Metallic chips. Spot test shows iron present. | None |

APPENDIX V

PROJECT HISTORY - DYNAMIC AIRCRAFT COMPONENTS

I. Transmissions:

A. S/N A12-20 - Serviceable as Received

All flight tests were performed with this gear box installed in A/C SN 57-6103. Total flight time can be referenced in flight records for this A/C.

Approximately 20 hours dynamic ground testing performed with this transmission installed.

No tests were performed that could be considered detrimental to the flight status of this component.

B. S/N A12-142 - Crash Damaged as Received

Installed for approximately 2 hours ground run time - vibration reference only.

Later disassembled for removal and use of various component parts in tests listed as follows:

- 1. Input Quill Removed and annealed to approximately 1/2 hardness. Installed and tested for vibration and temperature in transmission S/N A12-78. Later removed from S/N A12-78 and will be shipped as a separate unit, painted red for purpose of identification.
- 2. Lubricating Jets Nos. 1, 2, & 4 Removed and silver-soldered shut (jet holes and slots). Installed in transmission S/N A12-78 for specific tests and later removed. Note: These jets were not returned to normal condition and will be retained by BxY for possible future testing.
- 3. Upper Planetary Gear Assembly Removed and installed in transmission S/N A12-78 as a result of bearing retainer failure in the gear assembly from that transmission. This original gear assembly from S/N A12-142 was not removed from S/N A12-78.
- 4. Sump Oil Drain Line Removed and modified for installation of electrical chip detector in transmission S/N A12-78. Miscellaneous parts will be packed and shipped separately.
- 5. Pressure Relief Valve Removed and installed in transmission S/N A12-78 for operational testing. Later reinstalled in S/N A12-142.

C. S/N A12-78 - 307 Hours as Received

This transmission presently installed on A/C S/N 57-6103. All potentially destructive tests were performed on this gear box. Specific tests performed and components effected as follows:

- 1. Approximately 6 hours ground run time with from 1 to 5 lubricating jets clogged. Original, unclogged jets are now reinstalled.
- 2. 0.015 inch flat filed on lower mast bearing inner race (Main Mast S/N C12-50). This mast is presently in this condition and installed in this transmission.
- 3. Approximately 30-minute ground run time with excessively low oil level for purpose of accelerated wear and resulting temperature and vibration effects.
- 4. Upper planetary gear assembly failure (bearing retainer) was an assumed direct result of tests outlined in paragraphs 1 and 3 above. This gear assembly was removed and replaced by an assembly from transmission S/N A12-142 for continuation of testing. The removed gear assembly will be shipped separately and painted red for purpose of identification.
- 5. Input quill assembly was removed and replaced by one which had gear and bearing annealed to 1/2 hardness. Upon completion of testing in this area, the original input quill was reinstalled.
- 6. Iron filings and chips were introduced in small increments as a quantitative evaluation of electrical chip detector operation. The total amount introduced in this manner is considered negligible in comparison to the particles present as a result of the bearing retainer failure outlined in paragraph 4 above.
- 7. Oil filter screen assembly was removed during a series of tests but has now been reinstalled.

II. Main Mast

A. S/N B12-39

Installed in transmission S/N A12-20 (Serviceable), used throughout flight testing and approximately 20 hours ground run time. Flight status of this mast has not been affected. Total flight time can be referenced in A/C flight records.

B. S/N C12-50

Presently installed in transmission S/N A12-78 which is now in the A/C, this mast was used in all tests conducted on that transmission (Ref. IC). Paragraph

I. C.2 should be specifically noted, where 0.015 inch flat had been filed on the lower mast bearing inner race. This was the only test performed that was specifically damaging to the mast itself.

III. Swashplate

A. S/N F19-12 - Serviceable as Received

Presently installed on A/C S/N 57-6103, this assembly was used throughout the testing program, both flight and dynamic ground tests. Just prior to the conclusion of testing, specific tests were performed to create an overheat condition by purging the swashplate bearing of as much lubricant as possible without complete disassembly. This attempt was unsuccessful, probably because of difficulty in removing sufficient lubricant by the method used. The bearing was not relubricated.

IV. Engines

A. S/N LE-00214 - Excessive Vibration as Received

This engine was never used during any phase of the test program. Presently canned and stored at NCGD.

B. S/N LE-00346 - Serviceable as Received

Used throughout flight tests and approximately 20 hours dynamic ground run time. Total flight time can be referenced in the flight log for A/C S/N 57-6103.

This engine came due for 200 hour inspection during the test program and is currently undergoing this inspection procedure at NCGD.

C. S/N LE-00112 - Due Overhaul as Received (500 Hour)

This engine is currently installed in the test bed A/C (S/N 57-6103) and was used for all tests which could be considered potentially damaging. Specific tests performed as follows:

- 1. Short-shaft misalignment Shims removed from right and left rear engine mounts in different instances.
- 2. NII turbine unbalance, performed by rotation of NII wheel to out of balance positions at 90° and 180° from reference marks.
- 3. V band coupling (combustion chamber), loss of torque to the point of free rotation.

4. Short-shaft unbalance by the addition of a tape-attached weight to the outside of the shaft section.

The above specific tests involved ground runs of varying duration to reach the point of stable operation and then record applicable data.

One condition of unknown origin was noted during the course of testing. An intermittent, audible noise was present for 10 to 15 minutes after the start of a ground run from cold condition. This cycling noise was apparently caused by some abnormal condition in the aft section of the engine.

V. Gear Box (42°)

A. S/N A13-12 - Serviceable as Received

This gear box was retained as serviceable throughout flight tests and most of the dynamic ground test program. However, loss of the replacement gear box (S/N A13-68) due to extreme test conditions (to be listed in Paragraph VB) necessitated disassembly and reinstallation of the drive and driven gear quills into the modified housing of gear box S/N A13-68.

The housing from S/N A13-12 and the damaged component parts from S/N A13-68 have been packed and shipped as a unit.

B. S/N A13-68 - Due Overhaul as Received

All potentially damaging tests were performed on this gear box. Specific tests and components parts affected are as follows:

- 1. Gear box misalignment Created by the installation of 1/2 inch spacers underneath the gear box at appropriate mounting points.
- 2. Input quill was removed and gear and bearing were annealed to approximately 1/2 hardness, then reinstalled and run for extended time intervals, noting resultant temperature and vibration changes.
- 3. Oil collector assembly has been removed and clogged in efforts to create an over-temperature condition. This condition was never cleared.
- 4. Two unexpected failures had occurred during the course of tests, probably resulting from repeated disassembly and extreme induced conditions as noted:
- a. Input quill duplex bearing failure consisting of a cracked retainer and rough operation.
- b. Loose input quill gear retainer nut allowed slippage of the input quill shaft.

5. Extreme low oil level condition created in efforts to accelerate wear on annealed components and fore valuation of resulting temperature increase.

All of the above noted tests involved ground runs of varying duration to allow A/C stabilization and accumulation of necessary data.

Cast quill retainers (external) were damaged on both input and output quills during the last of repeated disassembly and assembly operations. This necessitated disassembly and the use of quills from gear box S/N A13-12 for continuation of tests. (Note paragraph V. A.)

All internal components from this gear box have been removed and will be shipped along with the housing from S/N A13-12. The modified housing from this gear box and internal components from S/N A13-12 are presently installed on the A/C.

VI. Gear Box (90°)

A. S/N A13-15 - Serviceable as Received

It was the original intent to retain this gear box as a serviceable item. However, the input quill was removed by mistake and subsequent reassembly resulted in a cracked roller bearing. This bearing was removed and replaced by one from gear box S/N A13-90 and will be shipped in this condition.

B. S/N B13-510 - Due Overhaul as Received

This gear box was disassembled and the input quill gear and roller bearing removed and annealed to 1/2 hardness for installation and test in G/B S/N A13-90. The gear itself was later annealed for the second time to approximately 1/6 hardness and retested. Upon completion of this test, the gear was removed and will be shipped along with this donor gear box and the cracked roller bearing from S/N A13-15.

C. S/N A13-90 - Crash-Damaged as Received

All potentially damaging tests were performed on this gear box. Specific tests and component parts affected are as follows:

- 1. Input quill gear and roller bearing (removed from S/N B13-510), were annealed to 1/2 hardness and 1/6 hardness in separate tests and installed and run in this gear box. Gear was later removed (Ref. paragraph V.I.B.) and the original gear and heat treated bearing were reinstalled.
- 2. Metallic filings were introduced in small increments for quantitative analysis of chip detector operation. Upon test completion, the gear box was flushed and reserviced, however some residual particles may still be present.

3. Extreme low oil level tests were performed to accelerate wear on heat treated components and for over-temperature evaluation.

This gear box is presently installed on the A/C (S/N 57-6103). All original component parts have been reinstalled with the exception of the gear quill roller bearing which had previously been annealed.

APPENDIX VI ENGINEERING SPECIFICATION



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engineering Specification

CATEGORY Design (Preliminary)

SUBJECT

Automatic Light Aircraft Readiness Monitor (ALARM)

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1.0 Scope: This specification is issued to establish the design, fabrication and test of an automatic light aircraft readiness monitoring system.

2.0 Applicable Documents:

- 2.1 BxY Sales Order 616 (Statement of Work)
- 2. 2 BxY Installation Drawings (ALARM)
- 2.3 Project ALARM Phase I Report
- 2.4 Project ALARM monthly progress reports

3.0 Requirements:

- 3.1 General
 - 3.1.1 The system shall automatically indicate the Go/No-Go status of all aircraft components or operational conditions considered amenable to electronic measurement techniques.
 - 3.1.2 The resultant equipment shall be installed in the aircraft as part of the normal instrument array, and conveniently operable and observable by the pilot or co-pilot of the aircraft.
 - 3.1.3 Solid-state circuitry and miniature components shall be used throughout to minimize overall system weight and volume.
 - 3.1.4 The system shall perform as specified throughout an anticipated ambient temperature range of -20°C to +40°C.
 - 3.4.5 The system shall perform as specified when subjected to vibration as follows:
 - a. θ to 15 eps .5 inch D. A. displacement b. 15 to 500 eps 5 g
 - 3.1.6 The equipment shall be operated from the aircraft non-essential bus (provided this voltage is 28 VDC ± 20% and/or 105-125V ac, 400 cycle power from the Main Inverter. Power conversion modules (DC to DC or AC to DC) shall be of minimum size and weight and mounted in the battery or inverter compartments.

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3.1.7 Design shall be fail-safe wherever possible to the degree that failure will result in a No Go indication.

3. **2 Detailed Requirements**

- 3.2.1 Control/Display Section
 - The Control/Display section shall consist 3.2.1.1 of all switching and indicating components necessary to control monitor operation and indicate aircraft status.
 - Each monitoring channel shall be an 3.2.1.2 independent electrical configuration from sensor to indicator lamp.
 - Illuminated legends shall be employed 3.2.1.3 for each channel to identify the particular aircraft component or operational condition being monitored.
 - 3.2.1.4 The illuminated legend shall light to warn of a No Go condition.
 - 3.2.1.5 A single rotary switch shall be employed to select the following system modes of operation:
 - Off a.
 - Self-Check b.
 - Static c.
 - Dynamic
 - In-Flight
 - 3.2.1.6 A self check mode shall be provided in which all legends are illuminated to pass in self check "High" and all are extinguished in self check "Low".
 - The Self-Check "High-Low" selector shall be 3.2.1.7 a spring loaded toggle arrangement to prevent leaving this switch in "High" or "Low".
 - A satisfactory system condition when in 3. 2. 1. 8 self check "High" or "Low" shall illuminate a green indicator lamp labeled Self Check "Go ".

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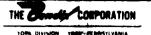
- 3.2.1.9 The Static mode shall be used to interrogate all channels not requiring start-up of the aircraft power plant as part of their proper measurement.
- 3.2.1.10 Dynamic and In Flight modes shall be used for interrogation of all channels requiring start-up of the aircraft power plant as part of their proper measurement.
- 3. 2. 1. 11 Dynamic and In Flight modes shall be identical with the singular exception that switching to In Flight changes No Go limits where necessary (See Para. 3. 2. 4. 13).
- 3.2.1.12 Illumination of any legend indicating a channel No Go in any mode other than Self Check shall also cause the aircraft Master Caution light to illuminate.
- 3.2.1.13 Switching provision shall be provided to "tock-out" each individual channel separately at the operator's discretion to prevent the Master Caution light being energized by this channel.
- 3.2.1.14 Switching provision satisfying para. 3.2.1.13 requirement shall be capable of remaining in the 'lock-out" position when subjected to shock approaching 50 g's, providing a record of switch positions if the aircraft crashes.

3.2.2 Interlocks/Continuity Channels

- 3.2.2.1 Channels indicating a No Go condition by operation of conventional switches shall be identified as Interlock channels.
- 3.2.2.2 If more than one switch is utilized in a particular channel to minimize wiring and/or number of separate indicator tamps, the maximum in such arrangements shall be six.
- 3.2.2.3 As a fail-safe consideration, operation of interlock switches shall be an open circuit indicating the No Go condition.

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- 3. 2. 2. 4 Channels indicating a No Go condition by providing continuity through sensing devices other than conventional switches shall be identified as Continuity Channels.
- 3.2.2.5 Each individual Continuity Channel shall have independent operation, including separate indicator lamp.
- 3.2.2.6 Self-Check of both Interlock and Continuity channels shall be such that complete continuity of wiring is checked and the indicator is energized by this continuity (may be independent of switch or sensor position).
- 3. 2. 2. 7 The Go condition (complete continuity) shall hold a current sensitive DPDT relay energized; the contacts of this relay shall be utilized for controlling the illuminated legend.
- 3.2.3 Temperature Channels (Analog)
 - 3.2.3.1 Channels indicating a No Go condition by operation of a thermostat or other temperature activated switching device shall be included as a Continuity Channel (See Para. 3.2.2).
 - 3.2.3.2 Channels utilizing analog-type of temperature sensors such as thermocouples shall be identified as Temperature Channels.
 - 3.2.3.3 All signal-conditioning circuitry and level detectors shall be of solid-state design and located in the main electronics chassis (with the Control/Display panel).
 - 3.2.3.4 Detection levels of these channels shall be individually adjustable and of sufficient range to insure capability of measuring to any temperature above ambient required by the system.
 - 3.2.3.5 Temperature detection levels shall be automatically adjusted +1 °C for every +2 °C change in ambient temperature.

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- 3.2.3.6 The output circuitry shall hold a currentsensitive DPDT relay energized until the pre-set detection level is exceeded; the contacts of this relay shall be utilized for controlling the illuminated legend.
- 3.2.3.7 Self checking of these channels shall be performed by control of the ambient temperature generator such that all channels are caused to indicate No Go in 'SC High" and Go in 'SC Low", where these two conditions are ≥5% above the No Go condition and 25% below it, respectively.

3.2.4 Vibration Channels

- 3.2.4.1 Channels indicating a No Go condition by operation of an acceleration switch or other vibration-activated switching device shall be included as a Continuity Channel (See para. 3.2.2).
- 3.2.4.2 Channels utilizing analog-type of vibration transducers such as accelerometers shall be identified as Vibration Channels.
- 3.2.4.3 All signal-conditioning circuitry and level detectors shall be of solid-state design and located in the main electronics chassis (with the control/display panel).
- 3.2.4.4 There shall be provided Vibration Channels capable of detecting peak velocity in the 20 to 500 cycle per second range and adjustable to operate from .1 to at least 10 inches/second.
- 3.2.4.5 There shall be provided Vibration Channels capable of detecting peak velocity in the 100 to 500 cycle per second range and adjustable to operate from .1 to at least 10 inches/second.
- 3. 2. 4. 6 There shall be provided Vibration Channels capable of detecting peak velocity in the 3 to 25 cycle per second range and adjustable to operate from .1 to at least 10 inches/second.
- 3.2.4.7 There shall be provided Vibration Channels capable of detecting peak acceleration in the 1 KC to 15 KC range, having a maximum sensitivity of .2 g at 15 KC and decreasing in sensitivity at the rate of 17 [±] 1 db/octave below 15 KC and at the rate of 45 [±] 2 db/octave above 15 KC.

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- 3.2.4.8 The characteristic provided per Para.
 3.2.4.7 shall be capable of adjustment such that the 15 KC sensitivity can be varied from .2 g to at least 2g without affecting the specified attenuation characteristic.
- 3.2.4.9 Self-Check of channels specified in Para.
 3.2.4.4 and 3.2.4.5 shall be accomplished by a 125 ± 5 cps signal introduced into the input in Self-Check High in place of the pick-up signal of an amplitude ≥5% above that required for a No Go indication at that frequency.
- 3.2.4.10 Self Check of channels specified in Para.
 3.2.4.6 shall also be accomplished as specified in Para. 3.2.4.9, with the exception that the signal shall be introduced into the channel immediately following the passive filter used to limit this channels upper frequency response limit to 25 cps.
- 3.2.4.11 Self-Check of channels specified in Para.
 3.2.4.7 shall be accomplished by a 7.5 ± 5 KC signal introduced into the input in Self-Check High in place of the pick-up signal of an amplitude ≥5% above that required for a No Go indication at that frequency.
- 3.2.4.12 Detection limits set into all vibration channels shall be held to within ± 3% over the specified ranges of environmental vibration and temperature (Para. 3.1.4 and 3.1.5).
- 3.2.4.13 All vibration channels shall be capable of having their No Go sensitivity reduced when the Mode Switch is moved from Dynamic to In-Flight.
- 3. 2. 4. 14 All vibration Channels shall be delayed a minimum of 10 seconds after the detection limit has been exceeded (except in Self-Check) before indicating No Go.
- 3.2.5 Flow Monitoring Channel
 - 3.2.5.1 A channel shall be provided capable of monitoring liquid rate-of-flow such as oil in the range of 2 to 7 GPM, with the flowmeter introducing no more than .75 psi pressure drop at a rate of 5 GPM.

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- 3.2.5.2 The channel shall be capable of detecting a decrease in flow rate equal to 3% of the nominal flow, or 1 pint per minute, whichever is greater.
- 3.2.5.3 Self Check shall be accomplished as described in Para. 3.2.4.9, with the exception that the 125 ± 5 cps signal shall be introduced during Self-Check Low and the channel shall not indicate No Go (assuming flowmeter output is a frequency proportional to flow rate).

3.2.6 Engine Speed Monitoring Channel

- 3.2.6.1 A channel shall be provided capable of detecting when the aircraft engine power shaft RPM exceeds the maximum specified by the manufacturer.
- 3.2.6.2 This channel shall receive its input signal from the power shaft tachometer generator used in the normal cockpit RPM indicating system.
- 3.2.6.3 Accuracy of this channel shall be ± 1% of nominal RPM limit setting over the specified ranges of environmental vibration and temperature (Para. 3.1.4 and 3.1.5).
- 3.2.6.4 The channel shall be capable of retaining the No Go indication occurring as a result of engine over-speed until it is reset manually by operation of a Reset switch.
- 3.2.6.5 Self-Cheek shall be accomplished by introducing the 125 ± 5 cps signal into the legal in place of the tachometer generator signal in Self-Cheek High to create the No Go indication (at this time the "lock-in" feature of Para. 3.2.6.4 shall be disabled.)

4.0 Materials and Workmanship

4.1 Materials used in the construction of the system shall be of a quality which is appropriate for the particular defication.

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- 4.2 Non-critical materials and standard parts shall be used whenever possible, provided such use in no way affects compliance with Para. 3.0 of this specification.
- 4.3 All items developed shall be fabricated and finished in a manner such that criteria of appearance, fit, and adherence to specified tolerances are observed.
- 4.4. Particular attention shall be given to neatness, thoroughness of soldering and wiring, plating, machine screw assemblage, and freedom of parts from burrs and sharp edges.

5.0 Inspection and Tests

5.1 Records of all inspection work and tests, giving the results of such tests, shall be available to the contracting agency at all times.

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